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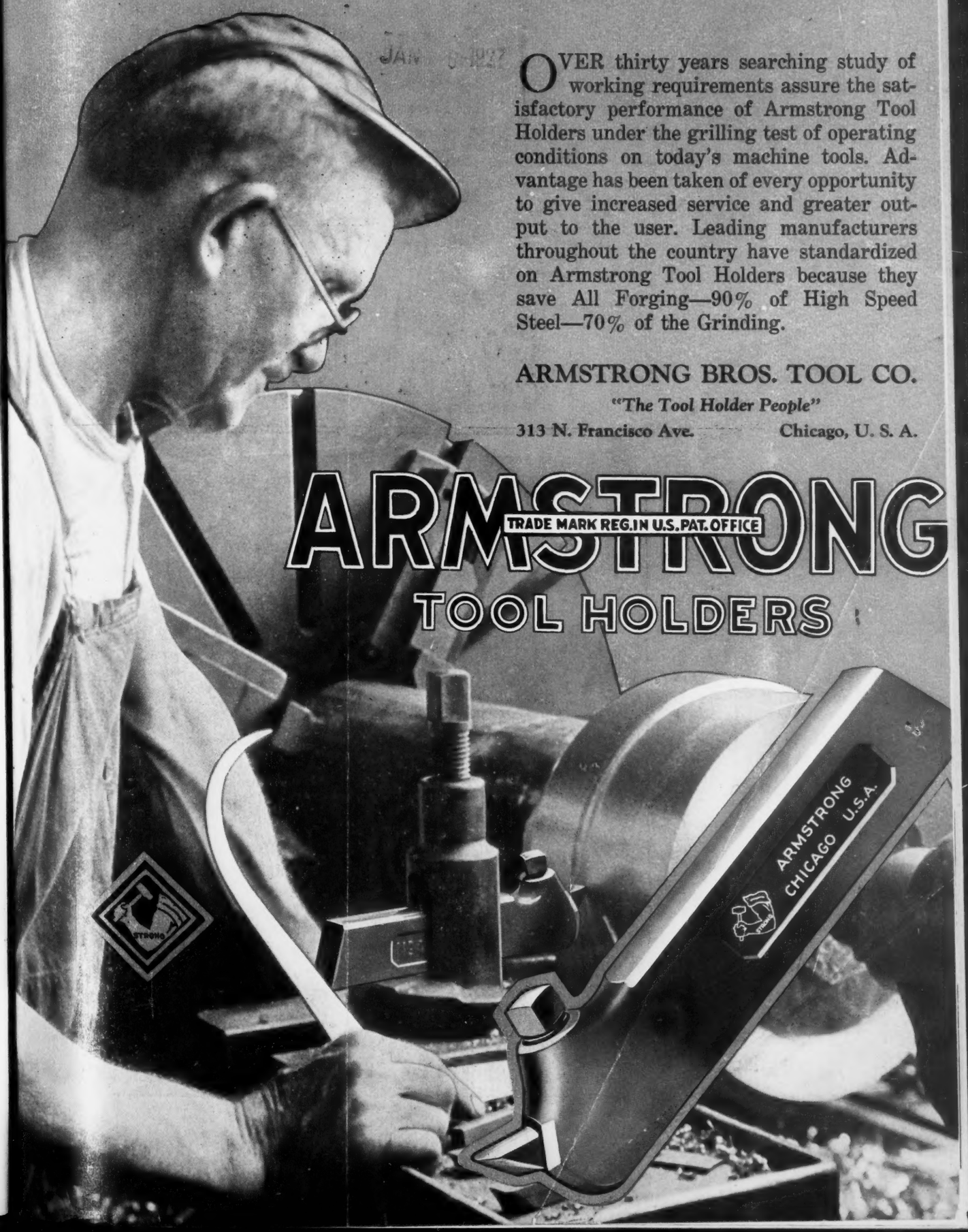
JANUARY 1927—THIRTY-THIRD YEAR

MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

JAN 6 1927



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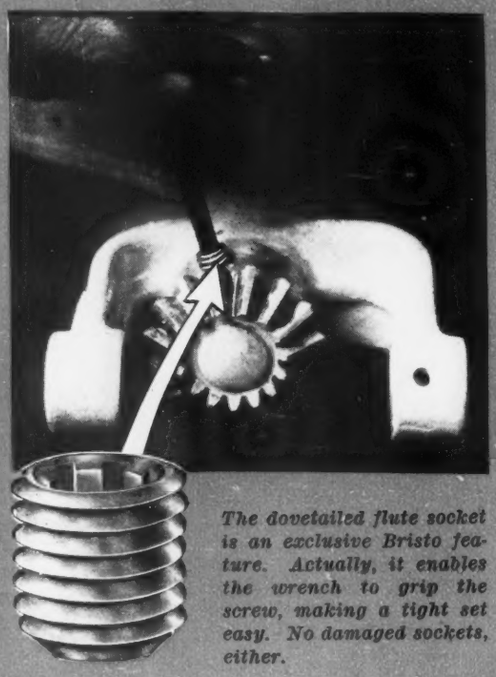

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The Bristol Co., Waterbury, Conn.

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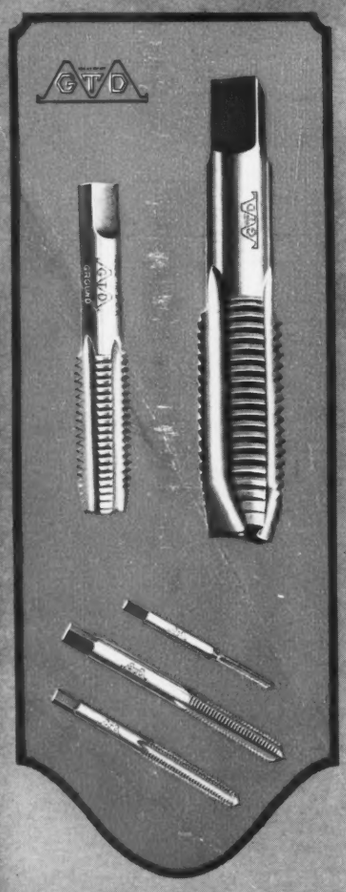

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GREENFIELD, MASS., U.S.A.

MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 33 JANUARY, 1927 Number 5

PRINCIPAL ARTICLES IN THIS NUMBER

Opinions of Industrial Leaders 321
The Business Outlook in the Machinery Field 339
The 1927 Outlook in the Machinery Industries 344
Systematic Control of Production—*By Charles O. Herb* 345
The Riveting and Welding Processes 350
Encouraging Employes to Make Suggestions—*By H. H. Dinkins, Jr.* 352
Things You Should Know About Patents—*By Leo T. Parker* 355
Oil-burning Annealing Furnaces—*By C. C. Hermann* 357
The Future of the Automobile Industry—*By Edward S. Jordan* 359
Machining Hupp Automobile Flywheels 361
Installation of Power Transmitting Shafts—*By J. H. Rodgers* 363
The Value of a Repair Parts Booklet—*By Harold B. Schott* 366
Cost Estimating in Contract Shops—*By James Allen Thomas* 369
Designing a Welded Steel Machinery Base—*By Robert E. Kinkead* 377
Carburizing in Rotary Machines 381
Reclaiming Car Axles in Forging Machines 383
The New Process of Chromium Plating 398

DEPARTMENTS

Letters on Practical Subjects 371
Shop and Drafting-room Kinks 375
Questions and Answers 376
New Machinery and Tools 385

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Product Index 304-326 Advertisers Index 329-330

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Four Presidents say:

In this issue of MACHINERY a great number of industrial leaders express their opinions on the problems facing the machinery industries during the coming year, and the presidents of four widely known and progressive companies incidentally refer to the necessity for using improved shop equipment.

Charles E. Adams, president of the Cleveland Hardware Co., says: "Profits must be made by reducing costs in the shop through improved methods and better machinery. The manufacturer who expects to be successful, with competition as keen as it is, finds it necessary constantly to buy labor-saving machinery. If he does not, he will be forced out of business by competitors who do."

Clifford P. Egan, president of the J. A. Fay & Egan Co., says: "The successful builder of machinery, if he is to hold his own in a highly competitive field, must believe in the doctrine of efficient equipment that he preaches. For this reason our company has installed a great number of modern machine tools during the past year. In 1927 many more tools will be replaced, with the object of reducing costs wherever possible, while at the same time quality is maintained or improved by the better equipment."

C. R. Messinger, president of the Chain Belt Co., says: "Our company spent more on improved plant facilities in 1926 than in any previous year, and will continue this policy. Old type machines are constantly being replaced by more efficient equipment to meet the necessity for lower manufacturing costs."

G. A. Rentschler, president of the Hooven, Owens, Rentschler Co., says: "Keen competition can be successfully met by reducing the cost of production with the use of modern equipment. No one can expect to hold his own in the machinery field if he uses antiquated plant equipment. Costs can be reduced by the use of modern machine tools, not only in plants producing in quantity, but in shops where only a few units of each machine are built. Our company constantly replaces old machines by new, more highly efficient production tools, and has been able to reduce costs to an extent that encourages us to follow this policy in the future to an even greater extent."

MACHINERY

1927 Opinions of Industrial Leaders

The Prospects for the Coming Year as Seen by Leading Executives in Different Branches of the Machine-building and Metal-working Industries

THERE has been a larger production in 1926 in almost every industrial field than in any previous year; the beginning of the new year finds industry in an optimistic state of mind, looking forward to a year of steady business.

MACHINERY has, as in past years, obtained first-hand statements from a large number of men prominently identified with numerous fields in the metal-working industries. The opinion of these industrial leaders furnish a reliable basis for estimating the business that may be expected during the coming year. The factors that are particularly encouraging are the absence of boom conditions, general employment at good wages—with the accompanying strong purchasing power of the industrial population—satisfactory credit conditions, and stable prices.

Charles L. Lawrance, President
Wright Aeronautical Corporation

AIR TRANSPORTATION

By CHARLES L. LAWRANCE, President
Wright Aeronautical Corp., Paterson, N. J.

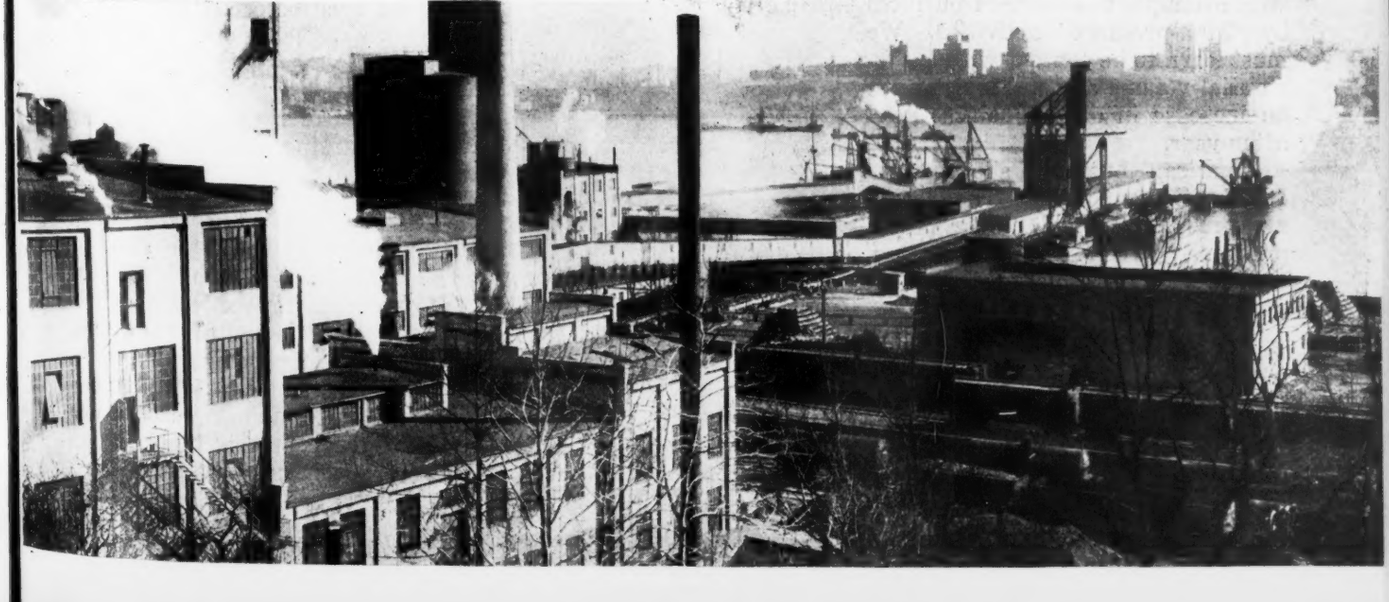
The year 1926 is the first in which commercial aviation in the United States over regular routes has been undertaken on a fairly large scale. Principally as a result of the Post Office Department letting contracts for air mail lines in different sections of the country, a number of companies have started carrying air mail, express, and passengers, in many cases on a successful financial basis.

It is very difficult to predict the growth of this business, but the fact that millions of miles have been flown, with an absence of accidents that seems almost phenomenal to those not acquainted with modern aeronautics, leads one to believe that the business will increase very rapidly during the next few years. An idea of the growth of commercial aviation may be obtained from the record of sales of aircraft engines by this company to other customers than the United States Government during the last few years: In 1922, none; in 1923, 5; in 1924, 15; in 1925, 63; and in 1926, 123 engines.

The aircraft business with the United States Government is on a satisfactory basis. The adoption of a five-year program by the Army and the Navy, and the recommendations of the Morrow Board and the Lampert Committee have resulted in an attitude on the part of government officials which is of assistance to the growing aircraft industry, giving manufacturers continuity of production of their various articles at prices on which a profit can be made, without delays in collection.

By WILLIAM B. STOUT, President
Stout Metal Airplane Co., Airplane Division, Ford Motor Co.,
Dearborn, Mich.

Aviation today is in much the same position that the radio was five years ago. It has taken a sudden jump on account of the increased confidence on the



part of the public in present-day passenger planes and the changed attitude of the insurance companies toward flying, as a result of actual statistics. There is a rather complete revision going on in airplane design, leading to lighter planes of greater capacity and strength.

The air-cooled motor has entirely supplanted the water-cooled type for airplane work. This is due to its great simplicity and long life. As new engines are being developed, new types of planes will appear in large numbers, with many new designs around each engine.

William B. Stout, President
Stout Metal Airplane Co.

It is expected that the Commercial Airplane Reliability Tour for the Ford Trophy in 1927 will bring out the first real radical commercial planes that have been developed since the war, and will mean the first absolute divorce of commercial from army and navy types of design.

This year has seen the establishment of a large number of air-lines. Some of these are already on a profitable basis, and others are approaching it rapidly. During the coming year it is probable that the carrying of express matter will also be undertaken. At the present time, the only strictly passenger air-line in the United States is the one operating between Detroit and Grand Rapids, Mich. By the end of next year there will probably be at least a dozen in operation.

THE AUTOMOBILE INDUSTRY

By WALTER P. CHRYSLER, Chairman of the Board
Chrysler Corporation, New York

The automotive industry has just concluded one of the best years of its history, and present indications lead me to believe that 1927 will be practically as good, which is about all anyone could ask for. The automotive industry is enjoying what might be described as prudent prosperity—that is, the industry has stabilized its business carefully, having kept its finances, its sales, production, and commitments well in hand.

There is only one real danger that I can see as I attempt to determine what we may expect in 1927. Business difficulties may result if business men should indulge in unwise attempts to stimulate business by "high-pressure" activities. We must learn to be content with a substantial volume and not insist upon an increase in every business year after year.

American business should face 1927 with confidence. The people are prosperous and enjoying their prosperity sanely. We have every reason to anticipate a good year.

By A. R. ERSKINE, President
The Studebaker Corp., South Bend, Ind.

There are so many factors that bear upon the course of business, and either break or make it, that forecasts projected far ahead are always risky. One of the most potent of these factors is the mental attitude or psychology of producers and business men toward productive undertakings.

Walter P. Chrysler, Chairman
of Board, Chrysler Corporation

At the present time, it seems that the volume of business this coming year in building operations, agricultural machinery, steel, automobiles, textiles and some other fields might possibly be somewhat smaller than the record-breaking volume of 1926. Nevertheless, business next year will doubtless be of large and profitable proportions. It cannot always be on an ascending scale, and the nation's prosperity does not require it to be. We have our ups and downs in business, but the post war position of American industries and export trade is so strong that we cannot have a really bad set-back in this country. Besides, the naturally optimistic, courageous attitude of American business leaders is, in itself, a considerable assurance against any major recession.

By J. R. HALL, Vice-president in Charge of Production
Chandler-Cleveland Motors Corporation, Cleveland, Ohio

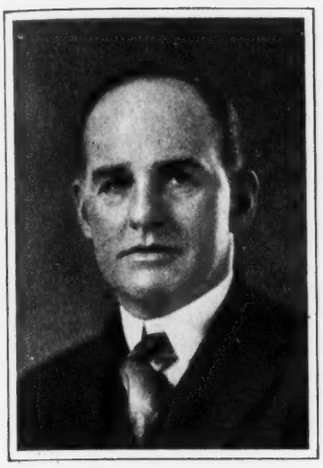
Two outstanding factors will contribute materially toward making the automotive industry equal, or possibly surpass, in 1927, its record production of 1926. These are the rapidly growing export market for American-made cars, and the greatly increasing tendency of the public to prefer the attractively colored, luxuriously upholstered quality-built type of four-door closed car in place of the volume-production model, of which the coach is an outstanding example. This tendency marks the lessening popularity of the drab and less colorful big-production model.

Other contributing factors to the industry's efforts to equal or surpass 1926 production are the natural development of outlying rural regions; the annual replacement demand for more than two million cars; the growing movement for better roads; the stabilization of installment-buying financing practice; and the generally sound business conditions throughout the country, which show every indication of continuing.

At the Show this year the cars themselves will have a greater appeal than ever before, since manufacturers have left nothing undone to improve their product not only mechanically, but also in appearance and comfort, while at the same time maintaining the existing low prices.

By ALVAN MACAULEY, President
Packard Motor Car Co., Detroit, Mich.

The coming year in the motor car business looks to me sound and promising. Fundamental conditions are good. Business generally is being conducted along careful and conservative lines. The purchasing power of the people is high; prosperity is general; good roads con-



Alvan Macauley, President
Packard Motor Car Co.

tinue to be extended in all directions; and everything I can find indicates a splendid season ahead of us. I do not look for a boom or for high-crest prosperity, but confidently expect better than a normal year.

By EDWARD S. JORDAN
President, Jordan Motor Car Co., Cleveland, Ohio

As I have pointed out in the article, "The Future of the Automobile Industry," published elsewhere in this number of MACHINERY, the year 1926 was unusual in most lines of business in that the expected summer slump did not materialize to the same degree as in past years, and this was true of the automobile industry as well. The most significant fact in the automobile business in 1926 was that about 400,000 automobiles were shipped abroad. We will continue for some time to be the work-shop of the world in the business of automobile transportation. The saturation point in the domestic demand will not be reached as long as people will not walk and cars will wear out. Hence, this industry need not be apprehensive about the future.

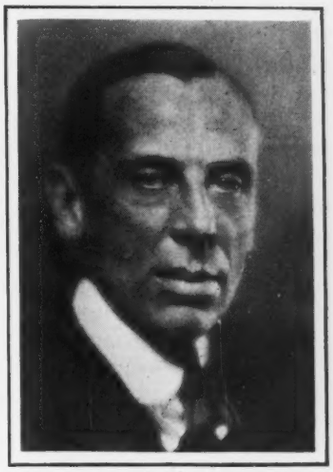
[A more complete statement relating to many of the problems of the automobile industry will be found in Mr. Jordan's article "The Future of the Automobile Industry" on page 359 of this number of MACHINERY.—EDITOR]

By C. W. NASH
President, Nash Motors Co., Kenosha, Wis.

There is nothing in the general business conditions of the country today that should make us feel that we cannot expect a normal business in 1927. While the cotton crop was "too good" this year, making the price too low, and the early frost damaged some of the corn crop, and wet weather some of the wheat, I believe that we will overcome these drawbacks and find ourselves in a healthy position. If business men, as a whole, will operate their various enterprises along sane and economical lines, we are bound to have a very satisfactory business in 1927. The rest of the world is getting into a somewhat better position to buy more American goods than in the last few years; this will also help.

I am very hopeful that labor will recognize the important part it has played in the affairs of our nation, and will proceed in the same manner as for some time past. This also has a great bearing on conditions in 1927.

So far as the automobile industry is concerned, I feel that its outlook is safe and sound, but I believe that there will be fewer manufacturing companies in the future than in the past, although automobiles will be made in large numbers and will continue to be improved each year. In this connection I do not see anything particularly hazardous in the financing of automobile sales for the retail buyer, when the financing is on a proper basis.



Alfred P. Sloan, Jr., President
General Motors Corporation

By ALFRED P. SLOAN, Jr., President, General Motors Corp.

There is reason to expect that 1927 will be another good year for the automobile industry—perhaps not so good as 1926, but a satisfactory year; 1926 has exceeded any previous year in volume of automobile production and sales; domestic consumer demand has broken all records and export business has been the largest in history. During this year over 4,500,000 passenger cars, trucks and busses were produced in the United States and Canada—6 or 7 per cent more than in the previous record year of 1925. Indeed, the last four years have been a period of very satisfactory automobile volume, the total output of the industry in the United States and Canada in these four years having been about 16,500,000 vehicles, or an average of approximately 4,125,000 a year. It now seems reasonable to expect that the 1927 production will equal, if it does not exceed, this four-year average.

The volume of replacement automobile business is increasing rapidly, and the overseas demand is steadily expanding; the additional volume from these sources in 1927 will go far toward offsetting any reduction of new user buying in this country.

Of course, the domestic automobile demand will be affected by general business activity; and although there is some uncertainty as to what the level of general business activity will be next year, there appears to be little likelihood that any drastic change will take place. This view is predicated upon the fundamental soundness of the present situation. In view of the foregoing, I think we may look forward to a year of good general business, even though it possibly will not be quite so good as 1926; and the same applies, in my judgment, to the automobile business.

Standish Backus, President
Burroughs Adding Machine Co.

BOOKKEEPING, ADDING AND CALCULATING MACHINES

By STANDISH BACKUS, President
Burroughs Adding Machine Co.,
Detroit, Mich.

The volume of sales of the Burroughs Adding Machine Co. during the first six months of 1926 com-

pared favorably with the first half of 1925, but during the third quarter of this year sales were slightly less than for the corresponding period last year. When all the figures are in, we expect, however, that they will show a satisfactory volume of business for the last quarter. We believe that 1927 will yield a normal volume of business. The grain crop and cotton situations in the West and South are responsible for the decrease in business in these localities, and this, in turn, is reflected in other parts of the country that depend upon the West and South as markets, but we see no reason to be pessimistic about prospects for the coming year.

CHAIN AND CONVEYING EQUIPMENT

By CHARLES PIEZ
Chairman, Link-Belt Co., Chicago, Ill.

Our business curve, over a long period, shows alternate rises and recessions that recur with considerable regularity. The chart indicates that after every period of great activity, there is a recession, or pause, in which business catches its breath. Our volume in 1925 exceeded that of 1924 by 12 per cent, and our business during 1926 shows a similar gain over 1925. But there has been a slight let-up recently, and my impression is that we will do well in 1927 to hold on to the gain we have made in 1926.

Charles Piez
Chairman, Link-Belt Co.

Several weeks ago, a friend, who is at the head of a large corporation, said, "Do you think we are in for a slight let-up in 1927?", to which I replied, "Yes, do you?" "Yes," he said, "but what makes you think so?" "Darned if I know," said I, "but what makes you think so?" "Darned if I know" was his reply. And if I were asked at this time, I could give no better reply.

Perhaps business needs to catch its breath, to take an inventory, to survey the field for new opportunities. Perhaps my impression, so lightly founded, is wrong. At any rate, nothing points to more than a slight let-up, and this might readily be changed by an improvement in the agricultural situation.

CONVEYORS—CHAIN—CONCRETE MIXERS

By C. R. MESSINGER
President, Chain Belt Co., Milwaukee, Wis.

It is safe to say that in 1926 the volume of business in the material handling equipment field was the largest in the history of the industry. The output was about 10 per cent greater than in 1925, but more intensive competition and reduced margins between costs and selling prices have kept profits from being proportional to the increase in business.

At the present time, 1927 promises to be much the same kind of year. General conditions at the outset are satisfactory. Employment is general—at good wages—money is easy, and transportation is good. Furthermore, the standard of living is on a higher plane than ever before. Installment buying is making possible some of the comforts as well as the necessities of life for a constantly increasing number of people. There is no reason to believe that the desire for further comforts will abate. Some criticism of the extent of installment buying has been heard, but there is no objection to it in principle. Competition between finance corporations has to some extent let down the bars, and there has perhaps been a tendency to overdo long time financing. While it can be said that the country is committed to the time-payment plan, it must be kept on a sound and safe basis if it is to be an asset in our general business structure.

Competition in 1927 will be as intensive as in 1926, if not more so, and still lower costs through improved methods and labor-aiding machinery will be necessary. In 1926, the Chain Belt Co. spent more money on improved plant facilities than in any previous year, and will continue this policy. Old type machines are constantly being replaced by more efficient equipment to meet the necessity for lower manufacturing costs.

C. R. Messinger
President, Chain Belt Co.

It is hard to see how the much discussed five-day week can be generally applied. The principal requisite for prosperity in the United States, especially since we are competing in more and more of the world's markets, is efficient work and steady employment on the part of its population. The methods being equal, it is evident that it is not possible to produce as much in five days as in five and one-half or six days. If output is reduced, manufacturing costs will increase to the detriment of the workers themselves. It would also affect our ability to meet European competition abroad.

Manufacturers are fully awake to the necessity of keeping manufacturing costs low. This is illustrated by the fact that a few years ago builders of labor-aiding machinery, such as conveyors, trucks, and mechanical loading and unloading devices, found it necessary to sell the labor-aiding idea. Today manufacturers are seeking improvements in methods and machinery to reduce excessive labor costs. The conveying machinery industry has done much to help manufacturers in this direction.

THE DIE-CASTING INDUSTRY

By CHARLES PACK, Vice-president
Doehler Die-Casting Co., Brooklyn, N. Y.

The use of die-castings increased during 1926 to an unexpected degree, more die-castings being used than in any previous year. This increase may be attributed to the following conditions:

1. The die-casting industry profited by the general business prosperity. Die-castings are important factors in automotive construction, and 1926 was an exceptionally good automobile year.

2. Improvements made in die-casting practice have reduced costs and placed die-casting on a more favorable competitive basis compared with other methods of manufacture.

Charles Pack, Vice-president
Doehler Die-Casting Co.

3. Due to improvements made on the phonograph, the past year has witnessed a revival of this industry, and the die-casting industry has profited by the rebirth of the talking machine.

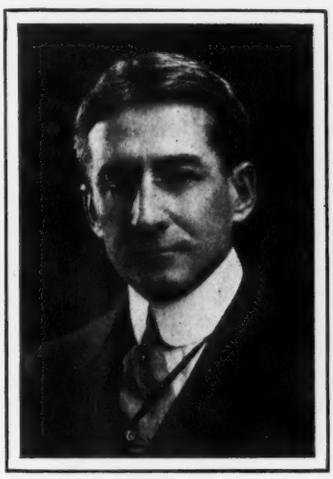
4. Extensive progress has been made during the year in the radio industry. Die-castings are important factors in reducing the cost of manufacturing radio receiving and amplifying apparatus.

The activity in the die-casting industry in 1927 will, of course, depend on general business conditions. All indications point to another good automobile year in 1927. A record year for talking machines is also expected. The indications in these two industries point to good die-casting business in 1927; and the future of the radio industry will have a strong influence on the die-casting industry. It is hoped that Congress will promptly enact the necessary legislation to place control of the "air" with a properly vested authority, thereby permitting the radio industry to continue its progress.

A year ago, the writer emphasized the value of low zinc and aluminum prices to the die-casting industry. This remains an important factor in the growth of this industry. Low zinc and aluminum prices will stimulate die-casting output, whereas higher prices will retard the growth of the industry.

THE DROP-FORGING INDUSTRY

By CHARLES E. ADAMS, President
The Cleveland Hardware Co., Cleveland, O.



Gerard Swope, President
General Electric Co.

The increased use of forgings in place of castings in many industrial fields helped to maintain the drop-forging business in 1926 at about the same level as in 1925. There is a tendency for the automobile industry to concentrate in the hands of a few companies, and along with this development, comes the tendency for the automobile manufacturers to equip their own forge plants and make their own drop-forgings; but the drop-forging industry, fortunately, can look to a great many other fields as an outlet for its product. The tractor industry has supplied a considerable demand, and the agricultural implement and machinery industry offers a growing business.

According to the present outlook, there will be about the same volume of business in 1927 as in 1926. The prospects in the automobile accessories field are good, new appliances being constantly developed. The agricultural outlook is not quite so good for the coming year, and the farm wagon business, formerly an important outlet for drop-forgings, is growing less with the increasing use of automobiles and trucks. On the other hand, good employment and the satisfactory credit situation are factors that promise a stable business in many other industrial fields.

Charles E. Adams, President
The Cleveland Hardware Co.

The hand-to-mouth buying policy is here to stay. It is made possible largely by satisfactory railroad transportation. Generally speaking, it is a satisfactory method of doing business. It reduces inventories and does not necessitate the tying up of capital in large stocks. All lines of manufacture are conducted more closely in accordance with current demands.

Competition is very close, and profits must be made by reducing costs in the shop through improved methods and better machinery. The manufacturer who expects to be successful finds it necessary constantly to buy labor-saving machinery. If he does not, he will be forced out of business by competitors who do.

THE ELECTRICAL AND POWER PLANT EQUIPMENT INDUSTRY

By GERARD SWOPE, President
General Electric Co., New York

In the electrical industry, we are looking forward to the year 1927 with confidence, and believe that the high rate of business that has been done this year will be continued in the next. The electrical industry is fortunate in that new uses and new applications of electricity are constantly being made in the homes and in the work-shops.

By General OTTO H. FALK, President
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

In this review last year, it was stated that if the Allis-Chalmers Mfg. Co. did the same volume of business in 1926 as in 1925 it would be satisfactory, but that a still greater volume might be expected. This prediction proved correct. The business in 1926 was nearly 20 per cent greater than in 1925, the electrical power plant field being especially active.

The prospects for 1927 are good. Stocks of all kinds are comparatively small, excellent railroad service having made possible buying for immediate needs only. This, in itself, should produce a steady demand for manufactured goods. More equipment will be required by the public utilities corporations, and there is every reason to believe that the railroads will be in the market for at least as great a volume of equipment as in 1926. Sound, steady business, therefore, may be expected; especially is this true if no detrimental legislation is passed, obstructing business.

The country's prosperity to a large extent depends upon the prosperity of the railroads and of the public service corporations, because these fields are big buyers of all kinds of materials and equipment. They should be treated fairly, so as to be able to develop to a point to meet the country's needs. In almost all large cities improved terminal facilities are needed, and the railroads must spend a great deal of money in keeping up with the country's growth. To obtain the required capital, they must be able to pay a fair return on investments.

General O. H. Falk, President
Allis-Chalmers Mfg. Co.

Mechanically, the tendency is toward larger and larger units for power plants. Both steam and hydraulic turbines and electric generators are constantly increasing in size.

ELECTRIC FURNACES

By R. E. TALLEY
Manager, Electric Furnace Division, George J. Hagan Co., Pittsburg, Pa.

There is a definite place in industry for both combustion and electric heating, and in the majority of cases, it does not require any difficult figuring to determine the proper application. Our electric furnace business for 1926 shows more than a 50 per cent increase over 1925, and there is every indication that 1927 will show a healthy increase over 1926. Our unfilled orders will carry us well into the new year, and simply completing the developments that have already been started will insure a satisfactory volume of business for the year.

Farm machinery manufacturers have been trying out electric heat very carefully for a number of years, and during 1926 the good results of these tests have been evidenced by the placing of very substantial orders. This market bids fair to become a close second to the automotive field. Electric refrigeration companies have shown a marked interest of late in electric furnace equipment. Indications are that substantial orders for electric furnace equipment will be placed by this new industry.

The electric furnace industry as a whole is showing a steady growth, indicative of careful study by users and prospective users. The only disturbing factor in the industry is caused by the shortsighted and uneconomical policies of a small minority who apparently are willing to sacrifice the future for the sake of an immediate sale.

ELECTRIC AND PNEUMATIC TOOLS

By S. DUNCAN BLACK, President
Black & Decker Mfg. Co., Towson, Md.

Our 1926 business ran about 25 per cent ahead of 1925, and we are preparing for an increase this year of from about 20 to 25 per cent over 1926. We added about 60,000 square feet of factory space last year, and are therefore in position to take care of this.

Photo by Bachrach
S. Duncan Black, President
Black & Decker Mfg. Co.

We are fully aware of the depression talk that the daily newspapers are so persistently fostering, but feel that they are going to make a failure of it, and that 1927 will be, in general, as good a year as 1926. We expect to make it a better year for this company by aggressive sales and advertising efforts, together with the introduction of a number of new models of tools in the field we reach.

By R. S. COOPER, Vice-president and General Manager
Independent Pneumatic Tool Co., Chicago, Ill.

The number of unit tools sold by this company in 1926 was about 20 per cent greater than in 1925, the value in dollars and cents being about 17 to 18 per cent greater. The difference between the two percentages indicates a somewhat greater volume of sales in the smaller tools, which is due to the fact that in 1926 the users of large tools were not such active buyers as the industries where smaller tools are used—as, for example, the automotive industry.

The prospects for 1927 indicate that approximately the same number of unit tools will be sold, but as it is likely that the railroads and the locomotive and car builders will purchase more equipment, larger tools will be in demand, and the volume expressed in dollars and cents will be greater. At the same time, there is no likelihood of any falling off in the demand from the automotive industry.

Among the important factors in the stabilization of business at the present time should be mentioned the excellent railroad transportation, which has enabled many manufacturers to discontinue buying materials on a six months basis, changing in many instances to a six weeks basis or less. This makes for safer and sounder business.

By F. W. SINRAM
Treasurer, The Van Dorn Electric Tool Co., Cleveland, Ohio

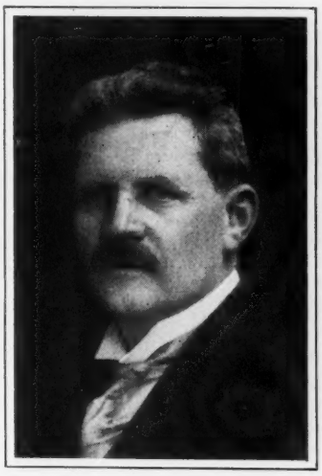
The year 1926 closed with a material increase in the number of electric tools sold, as compared with the preceding year—approximately 30 per cent.

Portable electric tools (drilling and reaming machines, grinders, screwdrivers, electric wrenches, etc.), in the early days of the industry largely confined to the production plants, are now widely used for service work wherever electricity is available.

The facility of the electric drill ("take the machine to the work instead of the work to the machine") and its economical hole-making proclivities have made it indispensable for multifold purposes. The utility of the electric screwdriver and the electric wrench is now generally appreciated, and the electric grinder makes for both convenience and economy. There is every indication that 1927 will record an increased demand, both domestic and foreign.

ELEVATING, HOISTING AND CONVEYING MACHINERY

By H. HARNISCHFEGER, President
Harnischfeger Corporation, Milwaukee, Wis.



H. Harnischfeger, President
Harnischfeger Corporation

Our business during the past year has been the largest in the history of the company, showing approximately a 10 per cent increase over the previous year. We have broadened our markets by opening new branches, by making foreign connections, and by intensive advertising and selling campaigns. We have spent large sums of money in improving our product and adding new production machinery in our shops.

As regards the outlook for 1927, we feel that there is nothing fundamentally wrong with the economic situation generally. There may be a temporary slow-up at the beginning of the year, but such a recession will be only temporary and of the kind that may be periodically expected. Business is on the up grade, and will be good in 1927 for those manufacturers who go after it with intensive and aggressive efforts.

By H. L. DONAHOWER, President
Standard Conveyor Co., North St. Paul, Minn.

Year-end prognosticators are somewhat in disrepute and are getting cautious. As a general rule, I think, we are all afraid to predict a continuance of prosperity after having had two years of it. I have a feeling, however, that we should take note of certain changed conditions. The Federal Reserve Bank exerts a beneficial influence in preventing inflation and tight money. Hand-to-mouth buying is also a good innovation.

Why should we feel, as we have in the past, that because we have had two years of good times we couldn't have another one? I do not mean by this that a superlative condition can continue indefinitely, but it seems to me that readjustments will be less drastic than formerly.

Our fiscal year ending August 31, 1926, shows a healthy increase in sales over the preceding year. We have gone four months on our new year and are quite a little ahead in sales over the same months of last year. We expect to do more business in the fiscal year ending August 31, 1927, than we did in 1926.

The installation of conveying machinery is fast becoming a necessity with industrial concerns. Material handling machinery has a direct bearing on production costs, and if one important plant in an industry makes use of it, others are almost forced to do likewise. Conveying machinery performs a great service to the consuming public. It speeds up production and lowers costs.

ENGINES AND HEAVY MACHINERY

By G. A. RENTSCHLER, President
Hooven, Owens, Rentschler Co., Hamilton, Ohio

During the past year this company has built its first double-acting two-cycle Diesel engine of 3300 brake horsepower, to be installed in a United States Shipping Board vessel of 9600 tons, expected to be at sea early in the year. Recent tests of this type of engine have given highly satisfactory results and more than justified the expectations. It is believed that there will be a constantly increasing demand for these power units, both for marine and stationary purposes. This type of Diesel engine is unusually well suited for use as a standby engine, both in steam and hydro-electric power plants, and it is believed that in the future this engine will dominate that field.

The power press business during 1926 has been very satisfactory, the volume being appreciably larger than in 1925. The outlook for power presses is excellent, and it is likely that the volume of business in 1927 will exceed that of 1926.

There has been considerable activity during the past year in glass machinery, and the prospects for the coming year are bright. The demand is especially for equipment used in connection with the continuous method of glass-making.

The sugar machinery industry has been rather quiet during the past year. It is likely that in 1927 and 1928 there will be a great improvement in the sugar machinery field, because of the need for new equipment, especially in Cuba.

A great deal has been said about keen competition and the difficulty of securing an adequate return on capital invested; but keen competition can be successfully met by reducing the cost of production with modern equipment. No one can expect to hold his own in the machinery field if he uses antiquated plant equipment. Costs can be reduced by the use of modern machine tools, not only in plants producing in quantity, but also in shops where only a few units of each machine are built. Our company constantly replaces old machines by new, more highly efficient production tools, and has been able to reduce costs to an extent that encourages following this policy in the future to an even greater degree.

FIRE ENGINES

By CHARLES H. FOX, President
The Ahrens-Fox Fire Engine Co., Cincinnati, Ohio

The fire engine industry has experienced a steady business during 1926. It has been working to capacity for several years, and the prospects for

Charles H. Fox, President
The Ahrens-Fox Fire Engine Co.

1927 are that this activity will continue. Fire waste is mounting year by year, and a constantly larger number of municipalities are beginning to realize that "nothing is too good for fire-fighting apparatus." Unfortunately, there are, however, many localities where, for the sake of economy, inferior apparatus is installed. Whenever fire fighting apparatus is selected because it is cheap, it is invariably too expensive, because the cost of fire-fighting equipment is but a negligible factor compared with the losses caused by fire that cannot be gotten under control quickly. False economy in buying fire-fighting equipment, therefore, is one of the grave dangers in municipal adminstration, and a very costly experiment.

The second important thing in connection with this industry when its main purpose—that of reducing fire waste—is considered, is that firemen need more thorough training in order to make them fully competent to handle the highly developed mechanisms that are now embodied in modern fire engines. It takes a great deal of skill and training to operate and maintain in efficient condition the latest types of fire engines, and the educational phase should, therefore, be given careful consideration in all fire departments.

FORGE SHOP EQUIPMENT

By D. A. CURRIE, Vice-president and General Manager
Erie Foundry Co., Erie, Pa.

The past year has seen a number of important changes in drop-forging equipment. New designs in both board and steam drop-hammers have made their appearance, to reduce operating costs and maintenance. Standing apart as the major development of the year in this industry, is the four-roll board drop-hammer. Its popularity, because of low maintenance cost, is increasing rapidly.

The year 1926 has been, on the whole, very satisfactory. We have been free from serious labor disturbances, and while prices have been close, the volume of business has exceeded that of 1925. This is due to the increased production schedules during the early part of the year of the motor car builders. Foreign shipments, which generally amount to a considerable volume, have been lower during 1926 because of the condition of foreign exchange.

The prospects for 1927, for both our domestic and foreign business, are unusually bright. Prices are steady, labor well paid and satisfied, stocks of new and used equipment in the hands of dealers at a minimum, and our customers doing a satisfactory and profitable business.

D. A. Currie
Vice-president and General Manager, Erie Foundry Co.

THE GEAR INDUSTRY

By E. J. FROST
President, American Gear Manufacturers' Association, and President, Frost Gear & Forge Co., Jackson, Mich.

We have made no canvass of the gear industry to get statistics for 1926 regarding business conditions, or opinions on the outlook for the coming year, but it probably is fair to say that while the volume may have been good, net results have not equalled those for 1925 in the industry as a whole. Buying has been very competitive and, at least in the automotive field, quality has improved while prices have been lowered. Frequently the purchaser has placed on the gear maker a burden of useless refinement that would not have been required had the gears been made in the shops of the assembler.

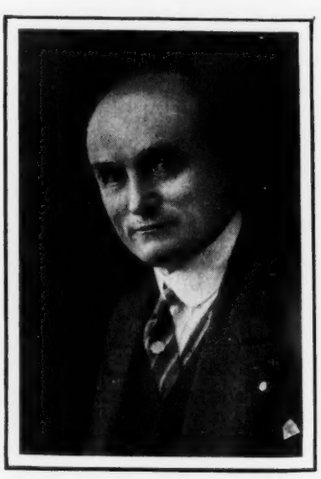
We realize the contribution our craft must make to progress, that obsolete equipment must be replaced by new when more efficient, that economies of every sort in shop management must be practised, that overhead in selling and administration must be kept to a minimum, and we believe that in most shops these details have been attended to. The gear industry is a highly specialized one, calling for high-priced, yet frequently short-lived, equipment, and demands men of marked ability, secured only through exceptional training.

It is our belief that purchasing agents and shop managers frequently base their ideas of the price of gears on perfunctory cost figures, which come to them from their own shops but which in no way represent *all* the expenses involved in production. We also think that in many instances factories, and especially those that are essentially assemblers, could buy their gears for less than they can produce them, and at the same time get a better product. To arrive at this same conclusion, a manager would have to be open-minded and go to the very bottom of his costs.

While it is possible that there may be some falling off in the volume of business for 1927, we do not think it will be serious, and we look for a fair year.

By F. W. SINRAM
Hon. Pres., A. G. M. A., Pres., The Van Dorn & Dutton Co., Cleveland, O.

Gears—a part of nearly every machine and device built—



E. J. Frost, President, American Gear Manufacturers' Association

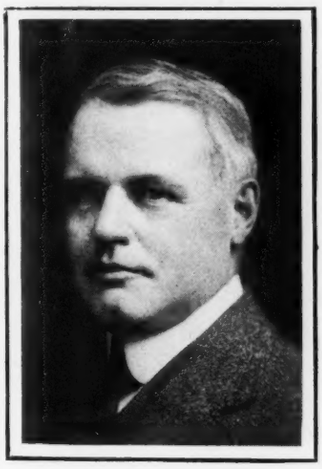
F. W. Sinram, President
The Van Dorn & Dutton Co.

reach into numerous fields. Taken as a whole, in the industrial and automotive fields, 1926 reflects a material increase in output, compared with 1925. Progress in many fields is creating new applications for gears of quality. Each year records an increasing number of progressive machinery and equipment manufacturers availing themselves of the experience and specialized facilities of the gear specialist. To these, a proper selection of the source of supply has meant better gears, frequently at a saving in ultimate cost.

An encouraging feature of the last half of 1926, indicating confidence, was a tendency to plan ahead conservatively, as against "hand-to-mouth" buying —often not economical. The year 1927 opens with many lines of machinery doing a pleasing volume of business. While seasonal demand has affected some lines, definite progress in others is assuring. There is every reason to expect an increased output in 1927 over 1926.

THE MACHINE TOOL INDUSTRY

By JAMES E. GLEASON, President
National Machine Tool Builders' Association
and President, Gleason Works,
Rochester, N. Y.



James E. Gleason, President
National Machine Tool Builders' Association

Years ago it was considered unbusinesslike, and even unpatriotic, to talk about a slowing up in business. Today we try to face the facts. Of late so many wise men, who make this industrial forecasting their business, have delivered their opinions, that an amateur in this line finds himself simply agreeing with expert opinion.

Expert opinion, in general, I believe, is that we will have some slowing up in the machinery line during the coming year. I believe that the statistics on orders gathered by the National Machine Tool Builders' Association are about our best guide for the future in the machine tool field. When we are all educated to the point where we will each contribute our share to the making up of these statistics, business will be in a fair way to stabilize itself.

By ERNEST F. DuBRUL
General Manager, National Machine Tool Builders' Association

The year 1926 was a period of "prudent prosperity" for the United States; but the machine tool industry did not share as largely as others in this condition. While other industries very generally surpassed even the boom years of 1919 and 1920 in volume of business, the machine tool industry's 1919 volume was about 50 per cent greater than 1926, while that of 1920 was about 20 per cent greater than 1926, as shown by our index of machine tool orders.

During the past year many machine tool builders have brought out new designs of great efficiency in production. Redesigned lines are now almost the invariable rule. So many lines of machines have been redesigned, and now embody features so far in advance of 1920 designs, that the industry can be said to have made obsolete almost all of the machines offered in 1920. This phase of the machine tool business seems to be much more profitable to the user of machine tools than to the builder.

As to 1927 prospects, certain factors are definitely less favorable than the same factors were at the end of 1925. Low prices of farm products seem likely to curtail agricultural purchasing power. Corporation reports of earnings show a declining tendency for the latter part of 1926.

Business men are now better informed and give more consideration to fundamentals than in 1919. They generally have given up the notion that business is not satisfactory unless it is increasing each year, and "watchful waiting" will prevent any undue pessimism developing from the action of perfectly normal causes. Therefore while 1927 may produce somewhat less business than 1926, it ought to produce a reasonable demand for machine tools of the newer cost-reducing type.

By EDWARD P. WELLES, President
Charles H. Besly & Co., Chicago, Ill.

The general business of our company, on the whole, will reflect a gain for the year 1926 of from 15 to 20 per cent over that of 1925. One feature that is especially interesting to us is that by careful scrutiny of our expense account and distributing facilities, we have been able to reduce our cost of doing business about five points, as compared to 1925.

With specific reference to our machine tool department, the increase is largely due to improved automatic and semi-automatic machines, as well as to redesigning what have heretofore been classed as more or less standard machines, equipping them with improved work-holders and fixture equipment. A step ahead has also been made in the last two or three years in the grinding members used. Furthermore, by a survey of the uses for our machines in fields other than metal-working, we

Edward P. Welles, President
Charles H. Besly & Co.

have increased sales. As a result, the sales of machine tools of our manufacture have been greater during 1926 than in any period since 1920.

Looking forward to 1927, we feel that the year will hold equal opportunity for the tool builder who bends his effort as much as possible to the elimination of manual labor in operation, and studies and investigates new fields and uses for his particular tool. We doubt very much whether the users of machine tools appreciate the improvement in design and productive capacity made by the machine tool industry. An opportunity to visualize such improvements will be offered at the National Machine Tool Builders' Exhibition in Cleveland next September, and should greatly stimulate demand.

By W. A. VIALL, Vice-president
Brown & Sharpe Mfg. Co., Providence, R. I.

The year just closed has justified the outlook that we had at the beginning of the year, that it would be a year of substantial business without a boom. Automotive purchasing probably will continue for a long while to be a large factor in the sale of machine tools. Fortunately for our industry, however, other lines are equally alert in replacing old equipment. This is a long process, and it looks as though the coming year would see more of it going on. It therefore gives encouragement as to a continuation, for the first part of the year, at least, of good business.

By E. P. BULLARD, Jr.
President, The Bullard Machine Tool Co., Bridgeport, Conn.

E. P. Bullard, Jr., President
Bullard Machine Tool Co.

In my statement in this review last year, I pointed out that in my opinion the machine tool user must consider, during the coming year, the *competition* with the modern-tooled plant that gives every aid to skilled and unskilled labor in producing quality and quantity output. This statement is equally true today, competition becoming more and more the outstanding factor in business.

To maintain our own position, we have purchased a large amount of new machinery during the past year, and we find that it pays us to do so. We intend to continue this policy during the coming year in an endeavor to use only equipment that is one hundred per cent efficient. Our preference, in every installation, is for automatic equipment; and we believe that this is distinctly the tendency throughout the industry.

By FRED A. GEIER, President
Cincinnati Milling Machine Co., Cincinnati, Ohio

Orders for the machine tool industry in 1927 should equal those of 1926—for those companies who can increase their selling efficiency. Although a slight falling off in automobile production is possible, increased competition will undoubtedly cause the industry to give greater attention to more efficient, more modern, and more productive machine tools. The electrical industry should show an increase in activity and in orders for machine tools.

The heavy strain placed on the railroads during the last two years through the effort to maintain their high efficiency has made it necessary for them to look for quicker and better methods of making repairs and replacements. Furthermore, there is a new attitude on the part of the railroad executives toward modern tool equipment, and this, combined with the fact that the railroads have the money to spend, should make the railroad field very active. Industrial machinery of various kinds should furnish the next best field for sales, although they may show a slight falling off before the year is ended. Foreign activity is uncertain, but should show an increase in orders over 1926.

Increased costs in the manufacture of machine tools and in distribution are matters that require serious thought and consideration on the part of the machine tool industry. If the industry is to be placed on a profitable basis, these costs must be still further reduced through an introduction of standardized methods of manufacture and greater efficiency, particularly in the selling and distribution of the product.

We are rather optimistic for next year, but are not blind to the fact that it is going to be harder to get business and that competition will be decidedly keener in all industries.

By H. L. FLATHER, Treasurer
The Flather Co., Nashua, N. H.

The return of "normal" business which was expected at the beginning of 1926 has not been realized in the machine tool industry. Manufacturers of single-purpose machines and machines readily converted into high-production units have been able to operate their plants at normal, and in some cases, at maximum capacity, but the buying of standard machine tools— a factor essential to normal business—has been lacking. However, recent reports from a number of machine tool manufacturers show an improvement in that the inquiries received originate from variety of sources, instead of from a limited number. This condition has not existed a sufficient length of time to determine whether or not it is only spasmodic, and whether these inquiries will remain merely inquiries, or be the forerunner of orders to come. If the latter proves to be the case, it would seem to forecast for the majority of machine tool builders a better year for 1927 than 1926.

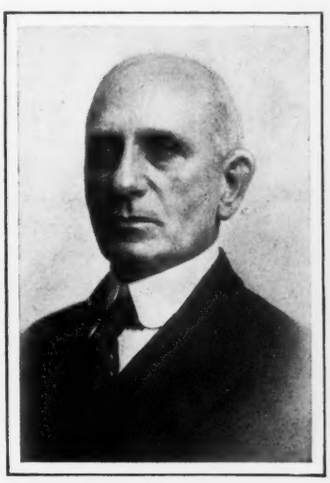
Although years have passed since the Armistice was signed, the world is still feeling the effects of the World War, and until the evils resulting from it have been eliminated, there can be no real prosperity. The United States is still suffering from two of these evils—over-expansion of practically all essential industries, and the jealousy of foreign nations. Confidence and good will are among the first essentials to secure business, and until we enjoy them in a greater degree than we do at present, we will not be able to obtain a sufficient volume of foreign trade to absorb the surplus products—both agricultural and industrial—produced in this country.

By HENRY MARX, President
The G. A. Gray Co., Cincinnati, Ohio

The year 1926 has shown a new trend in planer buying. A very large proportion of the planers purchased during 1926 were ordered to replace old machines. In other words, they were installed not so much because the customer required more equipment or greatly increased productive capacity, but because he wished to reduce the cost of his work with more efficient planers. From the great number of inquiries now pending, it is evident that an ever increasing number of firms are realizing the necessity of getting their planer departments on a low cost production basis, which means the replacing of old tools with modern labor- and time-saving planers.

If Europe gets on her feet industrially during the next year, the American manufacturer will have sharper competition in the home market, as well as in the export trade. The only way of meeting this competition, made possible by low-priced labor, will be to still further reduce our labor cost, not by cutting wages, but by using labor-saving machine tools to the fullest extent possible in our shops.

From present indications, 1927 will be a satisfactory year for the machine tool builder whose product has been so perfected that he can demonstrate a distinct operating saving over older models — something that many builders can do.



Henry Marx, President
The G. A. Gray Co.

By O. B. ILES, President
International Machine Tool Co., Indianapolis, Ind.

Our heavy turret lathe business in 1926 has been the best that we have had since 1919. Our orders have been to a large extent for more or less special machines—machines for special work, with speed- and feed-changing means omitted, but with many special holding and machining fixtures added. We have had comparatively few calls for straight standard machines.

The system of our engineering department in furnishing production estimates from samples or drawings seems to have found favor with many engineers and superintendents. These men seem to find that they can use to advantage the results we have obtained from twenty years of intensive study in heavy chucking and bar work.

From the requests for quotations we are now receiving, we think that we will have considerable heavy turret lathe business, at least in the early part of 1927. Our road men have made surveys and found that many of the wide-awake users of machine tools are becoming more and more convinced of the loss sustained by the use of old and obsolete machine tools. We are very optimistic and hopeful for good business in the heavy turret lathe line during 1927.

By RALPH E. FLANDERS
Manager, Jones & Lamson Machine Co., Springfield, Vt.

The year 1927 opens with very much the same elements to be considered as were met with a year ago. The actual conditions of business are prosperous. There are no large stocks of goods. Plenty of capital is available at rates that are not prohibitive. No signs of unwise expansion are found in any industry.

As to the unfavorable factors, real estate speculation has collapsed, and its losses have been absorbed without damage to the industrial situation. The agricultural situation is not so satisfactory as it was a year ago. The farmers will have less money to spend in 1927 than in 1926. Agriculture is still outside the charmed circle of American industry, with its chain of cause and effect, leading through high wages to high purchasing power, high production, high profits, back to high wages again. Our principal economic problem (it is not a political problem) is to bring agriculture into this circle.

O. B. Iles, President
International Machine Tool Co.

Another point is that the automotive industry is one year nearer that elusive saturation point than it was a year ago. The year will see further changes in the automotive industry along the line of a decrease in the number of companies, and the continued strengthening of the larger and more successful ones. This will, in the long run, be a good thing for the machine tool industry.

The writer still feels the need for caution that he emphasized a year ago; but he has come to realize that the sense of caution is present in the mind of practically every responsible business man, even during periods of comparative prosperity. This fact makes the need for extreme conservatism that much less necessary, and marks a new and desirable condition in the business affairs of the country. In brief, we dare not predict; we only hope that 1927 will be as good a year as 1926, which pleasantly surprised us.

By E. J. KEARNEY
Secretary and Treasurer, Kearney & Trecker Corporation, Milwaukee, Wis.

There are predictions current that there will be some recession in machine tool buying during the next few months. These prophecies may be based on sound reasoning, drawn from available facts, or they may be like the prediction of an old Indian that a "hard winter is coming because the white folks are buying lots of furs."

The machine tool business is becoming more and more a stabilized industry. Not only the machines, but also the selling methods, have been improved from year to year. Many dealers have abandoned their stores and opened offices instead. Gradually,

the large stocks formerly carried by dealers are being eliminated. Large stock orders from dealers are rarely offered, and are not solicited by wise manufacturers.

The machine tool builder no longer confines his attention to production, but keeps in touch with conditions in a wide field, both directly and through his association. This means that he is better informed than he was a few years ago, and deals more intelligently with boom and slack periods, reducing over-buying in one period and under-buying in the next. The Machine Tool and Steel Treaters' Exposition at Chicago last September, which is to be followed by an annual exposition of machine tools under the auspices of the National Machine Tool Builders' Association, together with better advertising, is keeping the users informed as to progress, which has a tendency to steady the market.

Prostration, due to the war, is slowly wearing away all over the world, and the industry can look forward to better conditions from year to year. I believe that the sales of machine tools during 1927, taken as a whole, will not fall below those of 1926.

By E. A. MULLER, President
King Machine Tool Co., Cincinnati, Ohio

Nineteen twenty-six has been a good year in the machine tool business, and progressive manufacturers may expect a very fair year in 1927—a year probably much like 1926. There will be little expansion in the industries using machine tools during the coming year, so that the machine tool builder will be mainly occupied with replacing old and obsolete machines with new and more highly efficient equipment. Manufacturers using machine tools, who recognize that they need more efficient and progressive methods in order to meet competition, will furnish the bulk of this business.

With competition keen and profits on a narrow margin, reduced costs through better methods and improved machinery are essential. In our own plant we have kept pace with progress by the necessary replacements, as we believe this to be the only way to meet the narrower profit margin successfully.

By R. K. LeBLOND, President
The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

I have always felt that one man's guess is about as good as another's in making prophecies concerning the future; but it seems to me that the year 1927 is going to be a very good one for the machine tool industry. Judging from our own experience, business has continued to pick up through the last half of 1926, and every indication is that it will continue favorable for the next six months. We, and many other machine tool builders, are closing the year with a satisfactory amount of business on our books, which was not the case last year.

However, the same old criticism still holds good in regard to prices on machine tools, which are entirely too low. The industry is still suffering from over-capacity, and competition is severe. The last two years have seen the greatest development in the history of the machine tool business. I think this was fully demonstrated at the Chicago Show. If this development has been charged to expense, the way it should be, there has been no profit in the machine tool business during this period; and when you take into consideration the amount of money invested in the business, the outlook on the basis of present prices is not very rosy. The consumer is certainly getting a wonderful bargain in machine tools. How long the machine tool builders will continue on this philanthropic basis I do not know, but I feel that this condition is improving.

By C. R. ROSBOROUGH
Secretary, Moline Tool Co., Moline, Ill.

Our business has been very satisfactory during the past year. In fact, we did a larger business in 1926 than in any previous year in the history of the company. The demand for our machines has not been confined to one particular industry, but has come from a wide diversity of manufacturing establishments, which is an indication to us that business in general was fairly prosperous last year.

We believe that 1927 will prove to be a satisfactory year from the standpoint of volume, but it is difficult to come to a definite conclusion that it will be better than the year just closed.

N. W. Foster, Vice-president and General Manager, National Acme Co.

By N. W. FOSTER
Vice-president and General Manager, National Acme Co., Cleveland, Ohio

In automatic machines, the business in 1926 has been practically equal to that of 1925; 80 per cent of this business has been for replacement purposes. Next year promises a good volume, with practically the same proportion of replacement business. The fields that will offer the largest volume of business will be the automotive and the automatic refrigeration industries.

In the foreign field, the prospects are fairly good. The demand from England and France is improving, the activity in France having been especially noteworthy during the latter part of the year. Business in Sweden has improved steadily for four years.

The machine tool builder's most serious problem is the excessive demand for service. Instances are on record where the services of demonstrators have been requested for as long a period as three months, to train the customer's operators and set up tools for them. The machine tool builder must adopt a policy of furnishing demonstrators for instruction purposes for a limited time only. After that, a special service charge must be made for the instruction of additional operators.

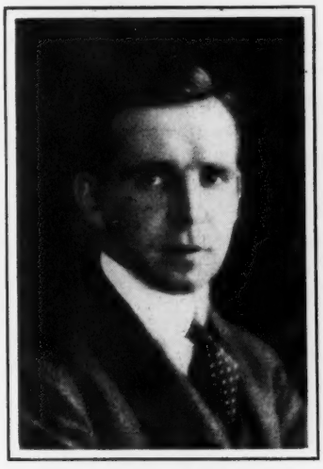
In the case of automatic machines, some of the large users are endeavoring to make their own repair parts, forming tools, etc. This practice is probably a very costly one to them, if they figured in all the costs involved. It is evident that the ma-

chine tool builder, with proper jigs and fixtures for manufacturing, can produce these parts cheaper and better, but the trouble is that the user seldom knows his complete costs, frequently figuring material and direct labor only.

By L. S. HORNER
President, Niles-Bement-Pond Co., New York

The machine tool business, as represented by the varied line of products made by our companies, shows improvement in 1926 over recent years, and it is believed that the first six months of 1927 should continue at about the same rate of activity.

There is, I sincerely believe, a growing determination on the part of the machine tool manufacturers to find economic, sound ways of proving to the great manufacturing companies using machine tools their responsibility to our industry to encourage improvement in design, reduction of types and kinds, and standardization of parts common to similar machine tools. There is a great need for this, as the machine tool industry has not shown, during the last five years, a return on even its reduced necessary capital investment, which the importance of this industry justifies. Without sufficient earnings, research, new development, and studies of quantity production demands, of necessity suffer. On the machine tool industry, depends to no small extent the great progress in manufacturing made by our country.



E. L. Ryerson, Jr., Vice-president
Joseph T. Ryerson & Son, Inc.

The automobile industry has shown what can be done by standardization of parts. Herbert Hoover has helped many industries to change from red to black, by elimination of waste, standardization, reduction in kinds and types, and above all, by the great advantage of better acquaintance, confidence, trust, and friendship between the executives of competing companies, so that they are willing unselfishly to improve conditions in an entire industry, and finally directly benefit themselves. May we make further advance along this roadway in 1927!

By C. L. ALLEN
President, Norton Co., Worcester, Mass.

The early months of 1925 produced a somewhat smaller volume of business than those in the later part of the year, while in 1926 just the reverse was true, the recent months showing smaller amounts in respect to orders received and shipments than the first six months. The difference between the two years is not great enough to have any special significance, and the total sales for the two years will not be very far apart.

As for 1927, we see no reason why it should not be, what can be properly termed, "a good year," even though the predictions of our own analyst and those of others who give publicity to their views, should prove true—namely, that the volume of business for 1927 will not be quite so large as that of 1925 or 1926.

By C. C. SWIFT
Secretary and Treasurer, Ohio Machine Tool Co., Kenton, O.

It seems that the year 1927 should be one of good business. There is no stringency in the money market and inventories are low. As unfavorable factors, of course, should be noted the slackening in building and the increase in installment buying. Although business is on an even keel, it would not take a great deal to throw it off its balance.

Companies in most lines of business last year have been simply exchanging dollars. Profits have not been very high. In the machine tool field, manufacturers have spent so much money on improving their products that when the end of the year came there was little or nothing left for dividends. A few good years in succession would help to correct this, and good business in 1927 will mean a great deal to the machine tool industry. Most authorities seem to agree that we may expect a fair business year.

By EDWARD L. RYERSON, Jr.
Vice-president, Joseph T. Ryerson & Son, Inc., Chicago, Ill.

The metal-working machinery and tool business in 1926 had the most satisfactory year since the war. The industry has probably been healthier this year than at any previous time, if we take into account the abnormal conditions existing in previous boom periods, which eventually reacted to the detriment of the entire business structure.

The volume of trade has been, in our case, decidedly better than in 1925, with a tendency toward a satisfactory distribution in all the important industries; also, the tendency has been toward fairly satisfactory sales in all lines of equipment rather than in certain specialized groups. Our machinery business encompasses a considerable diversity, and our results have suggested that machine shop equipment, railroad shop tools, structural working machinery, sheet metal machines, and other metal-working lines have fared about equally in the distribution of volume.

Our impression is that 1927 may be an even better year in this field than 1926, considering not alone volume, but also prices and net profits. The latter have not been satisfactory to the machine tool industry for a number of years, and the present tendency toward a better understanding of costs and toward the establishment of prices and profits on a sound economic basis indicates a trend that will be of vast importance.

The development of new designs and the promotion of special machinery that produces savings in production costs will become increasingly necessary. The tendency toward specialization is continuing, and every progressive concern must meet this demand in order to share in the available volume of business. We anticipate good buying in the railroad field, at least during the first part of the year. The automotive plants will undoubtedly require considerable equipment, and we prophesy good buying extending well into 1927.

By Colonel F. A. SCOTT
President, Warner & Swasey Co., Cleveland, Ohio

Total figures for the year 1926 are not yet available, but all indications are that the machine tool industry has experienced a good year. Volume was certainly larger than in 1925, and it is altogether probable that profits will also show an increase; but even so, the earnings on capital will still remain below the average of American metal-working industries. The general tone throughout the year was the same as that in the steel industry—strong and optimistic. There was a steady tendency toward a higher price level, the need for which has long been recognized by producers and appears now to be acknowledged as well by users. There is no economy in a policy of keeping machine tool prices so low as to prevent the development and expansion of the industry. Nobody is so helpfully affected by machine tool developments as the user.

There has been a ready absorption of the new designs which have constantly appeared since the war. The keen interest in everything new indicates growing appreciation by users—especially the big ones—of the fundamental and valuable service rendered by machine tool manufacturers.

The European and other foreign markets have been spotty, an encouraging demand having existed for certain tools and none whatever for other types. Speaking generally, there has been no improvement in European trade. From the Far East and elsewhere, however, good orders occasionally were received. Russia also did some buying.

Colonel F. A. Scott, President
Warner & Swasey Co.

The general outlook for 1927 is not so impressive as that at the beginning of 1926, but there would seem to be a reasonable prospect of good business, although little probability of a peak business.

MACHINERY AND SUPPLY BUSINESS

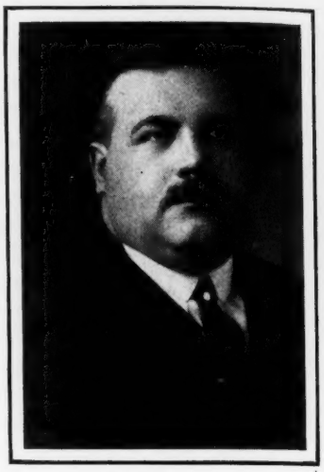
By B. H. ACKLES, President, National Supply and Machinery Distributors' Association; Manager, Factory Supply Department, The Rayl Co., Detroit, Mich.

The supply business, in general, during 1926 has been satisfactory. In Detroit and surrounding territory it has been equal to the 1925 volume. Indications are that 1927 will start out with a considerable volume of business. Automobile manufacturers are looking forward to considerable export business, which, added to the domestic demand, will keep automobile factories busy during 1927.

MATERIAL-HANDLING AND STEEL MILL EQUIPMENT

By JOHN H. BODE
President, The Wellman-Seaver-Morgan Co., Cleveland, Ohio

The business in material-handling equipment and steel mill machinery has been very satisfactory in 1926, and in the case of the Wellman-Seaver-Morgan Co., the volume has been from 20 to 30 per cent over that of 1925. Present prospects are that business in 1927 will reach approximately the same level as in 1926. The export business during the past year has been a big factor, running as high as 50 per cent of this company's output—South America, South Africa, Japan, and Mexico being among the countries to which large orders of material-handling equipment, chiefly for mining operations, have been shipped. The export business in 1927 is promising, and there will also be a fair domestic business in the replacement of rolling mill equipment.



John H. Bode, President
The Wellman-Seaver-Morgan Co.

Mechanically, big forward steps have been made in coal-handling equipment, especially in electrically operated car dumpers.

THE METAL-CUTTING STEEL FIELD

By CHARLES M. BROWN
President, Colonial Steel Co., Pittsburg, Pa.

The volume of business in metal-cutting tool steel in 1926 was approximately the same as in 1925, or slightly greater. Since July 1, there has been some recession, principally in the East. The consumption of tool steel has probably been greater than in 1925, as old stocks have in many instances been drawn upon and buying has been kept as close to current requirements as possible. The prospects for the first six months of 1927 indicate that there will be about the same volume of sales as at present. General production will probably continue at about the same level, calling for proportionately the same amount of tool steel.

The problem in this industry is the increasing demand for service. Every tool steel maker offers service with a view to increasing his business, but when each extension in this direction is imitated by competitors and such service is offered free by all makers, no one obtains any more business in the final result.

The services of the steel makers' metallurgists are being demanded more and more. Sometimes the steel maker is requested to send a metallurgist to a plant, when the situation is such that a solution of the problem could be made more readily and, in some cases, more satisfactorily by an experienced tool steel salesman.

The most troublesome situation in the tool steel industry, however, is that due to the extremely low prices prevailing for high-speed steel. This situation results from extensive competition, which has been based on the hope that increased volume of sales would decrease expense to an extent that profits would be secured through volume alone. This has not been the result. Prices of high-speed steel have been reduced during the past year in

Charles M. Brown
President, Colonial Steel Co.

the face of steadily increasing prices of tungsten. Hence, at the present time, there is no profit to the maker of high-speed steel, whether sold in large lots or in small quantities. If this condition continues much longer, it cannot but have its effect on the quality of high-speed steel. Prevailing conditions are economically unsound, and the steel maker is not receiving prices adequate to keep either organization or equipment in a state of such efficiency as permanency in the trade requires.

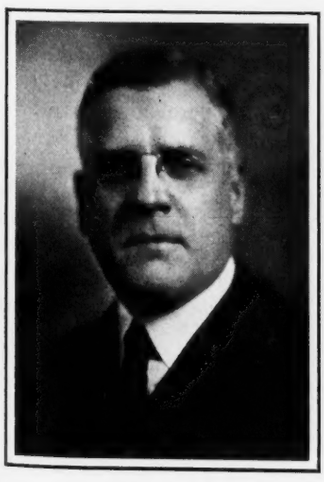
OIL-WELL EQUIPMENT

By S. CLARKE REED
Vice-president, Oil Well Supply Co., Pittsburg, Pa.

The production of oil in 1926 was the greatest in the history of the oil business, and the volume of business in oil-well supplies and equipment was approximately 20 per cent greater than in 1925.

It is difficult to make an accurate forecast of the future of the petroleum industry, because it is always possible that there will be an unusually great production of oil in some locality. This would reduce prices of crude oil to such an extent as to discourage new drilling. In my statement last year I mentioned that the only cloud on the horizon was a new pool at Garber, Oklahoma, but that this would not be likely to have an important influence on the total production in 1926. This assumption proved correct, but the outlook for 1927, while good from a general industrial viewpoint, is somewhat more uncertain because of the great Panhandle and Seminole developments.

Some means for stabilizing the production of crude oil is highly desirable. Such stablization has been virtually recommended by the Commission appointed by President Coolidge to investigate the petroleum industry. The Petroleum Institute will doubtless take steps to have these recommendations made effective.



S. Clarke Reed, Vice-president
Oil Well Supply Co.

The volume of the export trade has been very satisfactory. South America is coming to the front as a buyer of oil-well equipment. Some business was done with Russia, Rumania, and other oil-producing countries. If nothing unusual develops, 1927 should be as good a year as 1926, both in the domestic and in the foreign oil-well equipment field.

THE PRINTING PRESS INDUSTRY

By JOHN F. FALLON
Manager, Kelly Press Division, American Type Founders Co., Elizabeth, N. J.

We have experienced a satisfactory demand for automatic presses during 1926, and look forward to an even greater volume during the coming year. The distribution has been general throughout the country, and our foreign dealers have turned in many orders. While some sections of the country have their ups and downs, due partially to local conditions, we believe our 1927 business will show an increase of at least 25 per cent over 1926. Our factory is running on full time with a full quota of employes, and sales are equalling production.

PUMPS—GAS AND OIL ENGINES

By L. J. BELNAP, President
Worthington Pump & Machinery Corporation, New York

While a considerable portion of our product is pumping machinery, a very large and important proportion of our output is air, gas, and ammonia compressors, gas engines, and our newer developments in Diesel oil engines and locomotive feed-water heaters. Our bookings for the period corresponding to the year 1925 were somewhat in excess of last year, but we see nothing in the future to make us anything but optimistic for the early part of 1927, particularly in our Diesel oil engine development.

L. J. Belnap, President
Worthington Pump & Mchy. Corp.

Manufacturers in this country, more than ever before, are taking advantage of every opportunity for more economical manufacture and transportation, and the Diesel engine, we feel, is going to play a very important part in our future development. Our products cover a rather wide field, so wide in fact that one can scarcely think of an industry that does not make use of some of them. We feel that with greater knowledge and experience in the application of our newer developments, together with increased sales effort and more economical production, we will greatly increase our volume during the coming year.

THE SEWING MACHINE INDUSTRY

By A. S. RODGERS, President
White Sewing Machine Corporation, Cleveland, Ohio

In general, the sewing machine industry has progressed satisfactorily during 1926, and the White Sewing Machine Corporation and its subsidiaries have done between 10 and 15 per cent

more business than in 1925. A reasonable increase is looked for in 1927, 15 per cent being possibly a conservative estimate. Other leading companies in the industry will probably experience similar results.

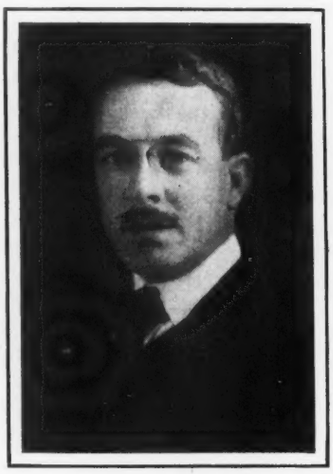
The electrically driven sewing machine continues to have a stimulating effect on the larger and more continuous use of the sewing machine in the home, although the introduction of this type brings with it the problem of increasing service. Those responsible for the affairs of this company are strong believers in the extension of our business through our own branch stores, operated in the principal cities of the country, because this gives us as manufacturers an opportunity to provide adequate service to the purchaser, which is a highly important factor in this field.

THE SMALL TOOL INDUSTRY

By JACOB D. COX, Jr., President and General Manager
Cleveland Twist Drill Co., Cleveland, Ohio

The twist drill business has really been better for 1926 than for any year since 1920. It is holding up well at the present time, but we anticipate some decline in the near future. In our opinion, general business will not be quite so good in 1927 as it has been in 1926, but we are not looking for any sudden or drastic decline. The decline that is already apparent in the automobile industry, the low prices of farm products—especially of cotton—and the approaching end of the building boom are the reasons for our belief.

By W. T. READ
Vice-president and Treasurer, Morse Twist Drill & Machine Co., New Bedford, Mass.



W. T. Read
Vice-president and Treasurer
Morse Twist Drill & Machine Co.

In looking back over the year 1926, it would seem as though most of the predictions for the year had been fulfilled—that is, in general, there has been a gradual increase in the volume of business, although the competitive conditions have not made possible any better price conditions, permitting of no great increase in profits, except where careful cost analysis and the use of more modern machinery have brought these about.

The pendulum has swung still further in the direction of hand-to-mouth buying, many times a customer being lost by not having goods on the shelves to care for immediate demand, and it is a question if the saving in investment has not been more than eaten up by the additional expense incurred. One of the things needed most today is an accurate knowledge of the cost of manufacturing and doing business, in order to establish selling prices that will give a satisfactory return.

As for 1927, there is nothing in view at the present time to warrant other than an optimistic outlook, but in these days of rapid changes, it is impossible to look further than a few months ahead. We anticipate, however, at present, continued satisfactory business conditions, both at home and abroad, unless some unforeseen change in the situation should arise.

STAINLESS STEEL

By JOHN C. NEALE, President
American Stainless Steel Co., Pittsburg, Pa.

The development in the application of stainless steel in 1926 has been greater than during all the previous years put together. When all the figures are in, the tonnage produced in 1926 will be found to be approximately 80 per cent greater than in 1925, although the tonnage of the latter year was much greater than for any previous year. The prospects for 1927 are bright. New uses are constantly being found for stainless steel, and it is not too optimistic a view to expect that a 50 per cent greater tonnage will be produced in 1927 than that produced in 1926.

There are now sixteen companies licensed in this country, producing stainless steel under the patents of the American Stainless Steel Co. in practically all forms in which ordinary carbon steel is rolled, such as plates, shapes, sheets, bars, wire, tubes, etc., and it is also available in cold-rolled sections. The makers of finished goods convert this steel into innumerable products, among the best known of which are cutlery, golf clubs, kitchen utensils, automobile parts, gun barrels, valves and fittings, measuring tapes and rules, range oven linings, acid pumps, coal screens, etc. In many instances, such as in the case of coal screens, this material is used because of its remarkable resistance to wear as well as to corrosion. There is a constantly increasing use for stainless steel in the canning industry, dairy field, and in the building of refrigerators, and new applications are constantly being found in the chemical industries.

A very much broader field of application is being developed for this remarkable material on account of its high physical properties, its toughness, strength, durability, and resistance to abrasion and heat, and these characteristics are now being recognized as determining factors in its adoption for many new uses.

TEXTILE MACHINERY

By JOHN F. TINSLEY
Vice-president and General Manager, Crompton & Knowles Loom Works, Worcester, Mass.

The year just closed has not been a satisfactory year in the textile machinery industry. In fact, it has been a very subnormal year for most of the machinery builders. The condition in the machinery business, of course, reflected a similar situation in the various branches of the textile industry. Throughout the first half of the year there was a depression in the cotton and wool trades. There was also a recession during the first few months of the year in the silk field. The carpet industry likewise was depressed.

Present conditions, however, indicate better business in the first few months of 1927. There has been a marked improvement in the cotton industry since last September. The demand for woolen goods has also shown a great increase, and both of these

industries are operating on a better basis now than for some time past. The prospects in both these lines seem good, since stocks are low.

It is to be expected that 1927 and succeeding years will see readjustments in various lines, all more or less depending upon great basic questions, such as the prosperity of the farmer and the international situation.

For the immediate present, notwithstanding probable readjustments incident to a slowing down in the building trades and in the face of a reduced purchasing power of the farmer, the general outlook, both as to the financial condition and the purchasing power of the country, is satisfactory.

THE TYPEWRITER INDUSTRY

By B. L. WINCHELL
Chairman and President, Remington Typewriter Co., New York

The typewriter business as a whole was good in 1925 and again in 1926. The average level of sales during these two years was considerably higher than in 1924. If we can "dig in" on this higher level and maintain it during the coming year, most of us will be pleased, though perhaps not satisfied.

Underwood & Underwood Studios, N. Y.

B. L. Winchell, President
Remington Typewriter Co.

In spite of the evident dislike of America and Americans in certain parts of Europe, the American typewriter business is improving abroad, our machines being recognized as the most efficient and the most durable made. Typewriter manufacturing has not reached a large development outside of America, partly because of the generally accepted belief in the superiority of the Yankee machine, and partly because no foreign manufacturer has established anything that we would call widespread or universal service. Unknown factors may affect the volume of 1927 business helpfully or harmfully, but with no unexpected change in the outlook, the 1927 business will not vary materially from that of 1926.

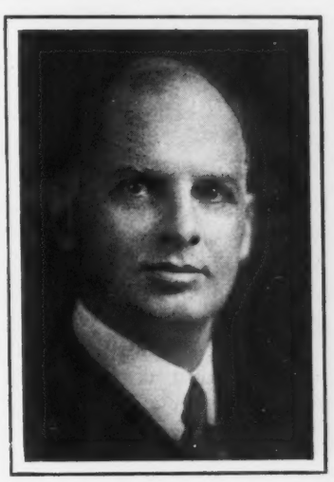
VALVES AND FITTINGS

By JOHN B. BERRYMAN
First Vice-president, Crane Co., Chicago, Ill.

In our business (valves and fittings, plumbing supplies, and kindred lines) 1926 has been quite a satisfactory year, the volume of sales having been approximately 10 per cent ahead of 1925. The demand from the building industry has been very heavy, although perhaps slightly less than in 1925, but the demand from the industrial field has been even greater. As far as can be judged at this moment, 1927 promises to be a good year. The building activity may taper off somewhat, but the industrial and power plant demand will be equal to or larger than that of the past year. On the whole, present conditions indicate that even if building activity is somewhat reduced, the total volume of business in 1927 may be as great as in 1926.

In this review last year, it was stated that the commercial aspects of this industry were not so satisfactory as the volume of business would indicate, because competition had never been so keen, nor the margin of profit so small. There has been a slight improvement in the competitive conditions, and the industry has probably realized somewhat better profits on the larger volume of business than it did in 1925. Speaking of business generally, there is at present no cloud on the horizon except that the installment buying practice has erected a credit structure which, if there were a serious recession of business, might prove very unstable. Should there be partial unemployment, time payments would cease, and manufacturing business generally would have to slow up. It is, therefore, of the greatest importance that all selling on a time basis should be handled in as conservative and as sound a manner as possible.

By HOWARD COONLEY
President, Walworth Co., Boston, Mass.



Harris & Ewing, Washington, D. C.

Howard Coonley, President
Walworth Co.

Our volume of business in 1926 showed an increase of 1 1/2 per cent over the 1925 average. This increase did not equal the gain of 1925 over 1924, but the earlier gain had already brought us to relatively high levels. After price disturbances early in 1926, there was a fair readjustment of price levels, but during the year 1926 as a whole, our prices averaged 4 1/2 per cent lower than in 1925. Consequently, the actual dollar income was 3 per cent less than in 1925. These are narrow limits of fluctuation for an industry that has been habitually erratic. Normally, increasing demand would cause prices to soar. In 1926 this combination did not take place. Instead, competition for the slightly larger volume has kept prices at conservative levels. This has been beneficial all around. It has prevented a wild boom that could only lead to setbacks later. Still, we are by no means convinced that the millenium is here. Building construction is sagging moderately. Automobile production is slackening off. In general, there is a tendency to "think it over" as the country is consolidating its rapid gains of the last few years.

We think a conservative attitude will be increasingly evident during the first and possibly the second quarter of 1927, but a depression is not in prospect. The year 1927 will be a good year. Volume in our field may be about 7 per cent less than in 1926. Prices may average over the year about 3 per cent less. Income would consequently decline by 10 per cent, but the average for the year should

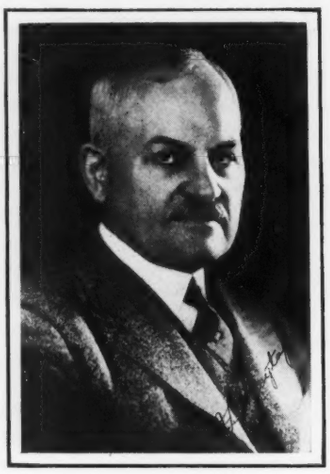
prove satisfactory where operating expenses are held down.

Since these figures are not for general industry, but for an industry that very often has erratic movements, these percentages for business in general, should be dampened by probably one-half. In other words, 1927 will not show any more than a moderate recession from 1926.

WASHING MACHINES

By F. L. MAYTAG
Chairman, The Maytag Co., Newton, Iowa

We have had a very successful year so far, and will make approximately a 67 per cent increase over the year 1925. Further we confidently expect to make 1927 give us an increase of at least 30 per cent over 1926. We see nothing in the future to discourage us in this estimate for 1927.



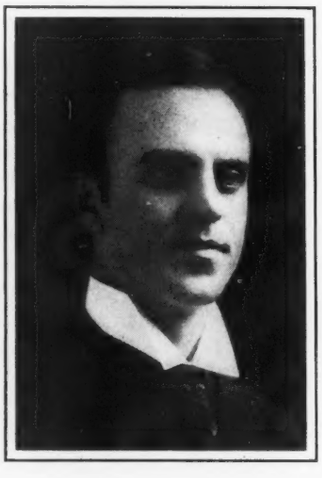
F. L. Maytag
Chairman, The Maytag Co.

THE WOODWORKING MACHINERY INDUSTRY

By CLIFFORD P. EGAN
President, J. A. Fay & Egan Co., Cincinnati, Ohio

The advantages of modern electrically driven woodworking machines are now more and more recognized by users of woodworking equipment of obsolete design. They are learning that it is not possible to meet the keen competition in the woodworking industry except by using equipment that reduces labor costs and increases output. These two purposes are well served by the modern electrically driven self-contained machines.

As a result of this recognition of the importance of the latest designs, business in 1926 has been about 10 per cent greater than in 1925, and the prospects for 1927 are satisfactory, no slowing down being in evidence; about the same volume of business as in 1926 can be confidently expected. The foreign business of the J. A. Fay & Egan Co. in 1926 was larger than it has been for fifteen years, and was well distributed all over the world. A still larger volume of export business is expected during the coming year.



Clifford P. Egan, President
J. A. Fay & Egan Co.

The successful builder of woodworking machinery, if he is to hold his own in a highly competitive field, must believe in the doctrine of modern efficient equipment that he preaches, and for this reason our company has installed a great deal of modern machine tool equipment during the past year. In 1927, many more machine tools will be replaced, with the object of reducing costs wherever possible, while at the same time maintaining or improving quality by the use of better equipment.

The selling and distributing end of the business must also be given thorough consideration during the coming year.

By GEORGE C. PURDY
President, Greenlee Bros. & Co., Rockford, Ill.

In our judgment, the year 1926 produced a volume of business in this industry somewhat greater than 1924, but not equal to 1923 nor 1925. From present indications, the year 1927 should average well as compared with the period from 1923 to date.

It is probable that the greater proportion of the expansion in the auto body, the furniture, and the millwork industries has already occurred, for the present industrial cycle. The volume of woodworking machinery sales must now be sustained chiefly through the replacement of older and less efficient machines by the latest and most highly developed electrified production machines.

A tremendous advance has occurred in the character and efficiency of woodworking machinery during the last five years, and the problem before the sales managers in this industry is to present to the management of every woodworking industry the concrete proof that an investment in a modern machine pays dividends.

WROUGHT-IRON PIPE

By L. M. JOHNSTON
Vice-president, A. M. Byers Co., Pittsburg, Pa.

The Byers Co. has shared fully in the prosperity that has prevailed during the past year. Notable gains have been made in nearly every important consuming market; especially have sales to railroads and the building industry been encouraging. A gratifying increase in business over the previous, and in fact, over all post-war years, was recorded. This cannot be entirely due to the good conditions generally prevailing, for not so many years ago the wrought-iron pipe industry was steadily declining. However, for several years now it has shown a decided upward trend, despite a considerable cost handicap.

We attribute this largely to a gradual realization—on the part of observant consumers—that genuine wrought-iron pipe has qualities of rust resistance and physical characteristics that, for many purposes, render it superior to a lower-priced commodity. A modest, though persistent educational compaign started by this company about ten years ago, has undoubtedly done much to increase public appreciation of this product. It follows that our expectations for the future are good. While we shall probably feel the effect of any general slump in business that may occur, it will not affect us nearly so much as would be the case if the trend toward wrought-iron pipe for permanent installations were not built on the soundest economic foundations.

The Business Outlook in the Machinery Field

Summary of the Opinions of Chief Executives in All Branches of the Industry

IN connection with the publication of this forecast of business conditions in previous years, it has been pointed out that no business can be successfully managed without a plan. A plan, in turn, presupposes a forecast—an estimate of the future. Every successful executive forms some kind of opinion as to the coming year in his own mind, and a summary of the opinions of a great number of business executives is very likely to form an accurate indication of what the business conditions will be.

With the object of obtaining such a consensus of opinion, MACHINERY has asked—as in previous years—more than 1400 executives in every branch of the machine-building, metal-working, and machine-using industries for their views on the prospects for business in 1927. The result of this inquiry, which is published in the following pages, covers a broad field of more than fifty distinct metal-working industries, many of which, however, have been grouped together under more inclusive headings to enable a brief concise summary to be presented in a reasonably limited space.

Agricultural Machinery and Implements

The business in the agricultural machinery and implement field was more satisfactory in 1925 and 1926 than it has been for several years. The output in 1925 was approximately from 20 to 25 per cent greater than in 1924; the business in 1926 increased approximately the same amount over 1925, very few concerns in the field reporting a smaller increase or a reduction. The farm tractor business was very good during the greater part of the year, slowing up slightly in the last few months. Generally speaking, the agricultural machinery and implement industry during 1926 was working at from 70 to 80 per cent of capacity.

The outlook for 1927 is not quite so bright as it was for 1926—a year ago. It is difficult to determine accurately how the cotton situation in the South and the crop conditions in the Northwest will affect the industry, but most manufacturers expect a slight, though not serious, reduction—averaging from 5 to 10 per cent.

The foreign business increased considerably in 1926, and the foreign trade outlook is satisfactory,

The Larger View of Industrial Progress

By Charles M. Schwab, Pres., American Society of Mechanical Engineers; Chairman of Board, Bethlehem Steel Corp.

At no time in history have the people of an entire nation enjoyed the prosperity prevalent in the United States today. At no time have people dreamed of the universal use of luxuries which we accept as our birthright. Our material prosperity is astounding—so remarkable, in fact, that business men are coming from all parts of the world to study our methods.

It is my hope that our spiritual and cultural prosperity will now show similar development. We have conquered poverty. Let us conquer disease. We have abolished illiteracy. Let us develop finer methods of education. We have saved time and increased production by making machines do our work. Let us make worthwhile our additional leisure.

We still have many problems before us. Our very prosperity makes foreign manufacturers cast envious eyes at our markets. To maintain our markets and our present high wages with reasonable profits for manufacturers, we must realize efficiency and economies on a progressive scale, not merely in production, but in marketing methods as well.

Both in industry and in agriculture there must be cooperation among the factors involved to an extent never before considered necessary or even desirable. Farming must be conceived on a more scientific basis. There must be greater integration of agricultural producing units. We must apply to our fields the methods of large-scale production that have been found successful in our factories. Waste in marketing must be minimized on the farm as well as in industry.

These things can and will be done through the cooperation of heads of industries, farmers, bankers, Wall Street men and ranchers. We have the greatest country in the world, and with intelligent effort, a feeling of humility, and faith in one another, nothing is beyond our power of achievement.

the best export fields being France, Spain, Italy, and South America. The export business with Russia is believed to be somewhat overestimated.

The Automotive Industries

The opinions of several leaders in the automotive field are quoted on pages 322 and 323 of this number of MACHINERY. The industry looks forward to a good year, and admits that it would be satisfactory even if it did not quite equal the 1926 record. Those who think that the total output may be somewhat reduced do not believe that the reduction will be more than 5 per cent, on an average, and this would apply to passenger cars only. Truck and bus builders are looking forward to substantial increases, varying from 10 to 20 per cent over 1926. In the accessories field, 1926 has been a banner year, and manufacturers in this branch expect at least an equal year in 1927, or a 10 per cent increase.

The Ball-bearing Industry

In this review a year ago, reference was made to several new developments in the ball-bearing industry, including the tendency toward the use of double-row bearings and the use of higher grade steel, both in balls and races. Progress along these lines has continued.

Leading ball bearing manufacturers report an average of from 5 to 10 per cent greater business in 1926 than in 1925. The prospects are that there will be about the same volume in the coming year as during the year just ended.

Blower Manufacturers Have Had a Big Year

The business in fans and blowers (other than small electric fans) reported by leading manufacturers has been from 15 to 20 per cent greater in 1926 than in 1925. The prospects for 1927 are that in the general industrial field the business will be about equal to that of 1925, and in some special fields, like gas works, will be equal to the 1926 volume. The probable reduction in building will affect this field unfavorably.

Boilermakers Expect an Increase in Business

While a few companies in the boiler field did an unusually large business in 1926, the average business was about equal to 1925, a few concerns reporting a reduction. The prospects for the coming year are for an increase in demand, variously estimated at from 5 to 15 per cent. The extensive building of power plants, which has aided the boiler business this year, will continue during the coming year. The tendency in this field is toward larger units and higher pressures, and for that reason there will be a considerable replacement demand in addition to the expansion that may take place in the power plant field.

Clocks and Watches

In the clock and watch industry, the average output, according to the information available in this survey, has been about 5 per cent less than in 1925. The prospects for the coming year do not indicate any increase in this volume.

Falling Off Expected in Cotton Ginning Machinery

Reports from well-known makers of cotton ginning machinery indicate considerable increases in the business in 1926. There is great variation in the percentage of increase, varying from 20 per cent up to, in one instance, 200 per cent. A considerable falling off is expected in 1927 due to the present price of cotton. Compared with 1926, it is estimated that this falling off will be from 30 to 50 per cent.

The Metal-Working Industries

By Paul T. Norton, President, National Metal Trades Association; President, Case Crane and Kilbourne Jacobs Co., Columbus, Ohio

The reports from the branches of the National Metal Trades Association indicate a net increase of 10.5 per cent for the first nine months of 1926, compared with the same period of 1925. As my interest in this subject is from the standpoint of the number of workmen employed and the amounts earned by the workmen, I might be pardoned for calling attention to the fact that good labor conditions are not the result of good business conditions, but on the contrary, good business conditions are almost always the result of proper conditions of employment. This is emphasized by the fact that in the open shop industries, such as steel, automobiles, machine shops, etc., any increase in the volume of business is immediately reflected in increased pay envelopes, increased prosperity, increased buying power, and general contentment; while in the industries controlled by the restricted closed shop policy, such as the building trades, the garment trades, coal mining, etc., an increase in demand frequently results in suspension of work, agitation, shifting of employment, and general interruption to the orderly processes of production.

Cranes and Conveying Equipment

Expressions of opinion from several leading men in the conveying equipment field are given on page 324 of this number of MACHINERY. During the past year, business, in some instances has been from 10 to 12 per cent better, in some, not quite so good as in 1925. The prospects for 1927 are that there will be approximately the same volume of business as during the past year, except in factory conveying equipment, where an increase of 30 per cent over 1926 is expected. More and more time is being spent by engineers and executives in studying production problems with a view to introducing labor-saving equipment, and this will have a favorable effect on the conveyor industry. During the past year some very noteworthy installations were made, and several large projects are under way at present.

The Cutlery Industry

Cutlery manufacturers report from 5 to 8 per cent increase over 1925. By aggressive sales efforts it is expected that an increase in this business of from 5 to 15 per cent is possible. The safety razor business has been approximately 15 per cent greater than in 1925, with prospects that this volume can be maintained during the coming year. A big increase in foreign sales is likely. The business in silverware has remained approximately the same during the last two years, and there is a favorable outlook for an equal volume of business in 1927.

The Electrical Machinery Industry

The leading electrical companies report from 5 to 10 per cent large volume of business in 1926 than in 1925, and expect a slight increase in 1927 over the big volume of 1926. Makers of electric welding equipment have increased their business by approximately 10 per cent, and look forward to from 10 to 20 per cent more business next year. New uses are constantly being found for the arc-welding process, which will mean increased business for arc welding equipment. The demand for electrically driven appliances of all kinds is growing rapidly, one concern increasing its volume by 45 per cent in 1926 and looking forward to a further 20 per cent increase in the coming year.

Excavating and Road-building Machinery

The volume of business in excavating machinery in 1926, according to the largest producers, was about the same as in 1925. Some of the smaller concerns, concentrating on fewer lines, report good business with increases of from 10 to 30 per cent in sales. The foreign trade improved, and American excavating equipment is now shipped to practically all parts of the world. Europe offers a keener competition in this field than formerly, and while the use of excavating machinery is increasing everywhere, American manufacturers must be prepared to meet active competition in the export field. The foreign outlook, however, remains good and promises a good year in 1927. The domestic business in excavating machinery, in the opinion of some manufacturers, will be somewhat less than during the past year; but while there may be a reduction in some directions, there will be an increase in others, and while some concerns look forward to a somewhat smaller volume, others expect from 10 to 20 per cent greater demand for their particular lines.

Prospects for 1927

By Julius Klein, Director, Bureau of Foreign and Domestic Commerce

The past year has seen greater activity in the machinery industry than any corresponding period since 1921, and this activity has furthermore been characterized by a most gratifying stability. For five years, the country has witnessed continuing industrial activity unmarred by serious depression. This is one of the longest periods of sustained prosperity that we have ever enjoyed. So steady has been the course of business that even the generally accepted trade cycle theory has come to be questioned and its relentless operation doubted. At the turn of the year we find the machinery industry prospering because general industrial activity has been, in the main, at record levels, with a tendency toward expansion. For a long time the railroads have been handling the heaviest tonnage in history. The pig iron and the steel ingot output have also established new records and created new demands for the machinery required in handling these products. Exports of industrial machinery have also been large and increasing, and for the entire year may be expected to exceed $160,000,000, in spite of the keenest competition abroad. Furthermore, the outlook is favorable, suggesting that 1927 may be even more prosperous.

The Firearms Industry

Leading manufacturers of firearms state that the volume of business in 1926 has been approximately 10 per cent greater than in 1925. An increase of 10 per cent in output during the coming year is expected by at least one manufacturer.

Forgings and Castings

The drop-forging business has varied appreciably according to the line of manufacture engaged in. The tendency of the large automobile companies to make their own forgings has reduced the business of independent forge shops in some cases, although the output of drop-forgings as a whole has increased. Independent manufacturers do not look forward to an increase in volume of business, but expect to hold their own in the coming year by finding new sources of outlet in instances where forgings are suitable to be used in place of castings.

The steel casting field has had a good year, some plants reporting up to 35 per cent increase in business, which they expect to be able to maintain in 1927. In the gray iron casting field, business in 1926 has averaged from 10 to 25 per cent more than 1925, and approximately the same volume is expected during the coming year. In the die-casting field, great progress has been made by many concerns, increases of 25 per cent not being unusual, with prospects for a still bigger business in 1927.

Forging and Foundry Equipment

The forging machinery industry has greatly improved its position in 1926. Makers of this kind of machinery report from 25 to 70 per cent larger volume of business in 1926 than in 1925. The prospects for the future are satisfactory, and there is no apparent reason why the volume of business in 1927 should not equal or exceed that of 1926. In the case of manufacturers who had an unusually big year in 1926, possibly a slight falling off may take place, but even then it is expected that the business will be considerably larger than in 1925. The railroads have not purchased forging machinery to the extent that it is believed they ought to, and a large business is anticipated from this source in 1927.

The demand for foundry equipment has been from 5 to 10 per cent greater in 1926 than in 1925. Some concerns in this field expect a reduction in 1927 of, perhaps, 5 per cent, while others look forward to an increase of 10 per cent. The main increase in business during the coming year will probably come from the substitution of improved equipment for obsolete equipment.

The Gear Industry

Some makers of industrial gears, especially gear reduction units for industrial purposes, had an unusually good year in 1926, with the outlook for 1927 satisfactory. It is evident that in an industry like that of industrial gear cutting, there would be great variations in different plants; some have held their own, as compared with 1925, while others report increases in business, up to 20 per cent, and look forward to a further increase of from 20 to 25 per cent in 1927.

The tendency is toward a higher grade product in the gear business. Heat-treated gears and gears with ground teeth are in greater demand than formerly. Those who specialize in the best quality of gears, therefore, have had a proportionately larger share of the business. The demand from the steel industry is largely due to the remodeling of mills. The quality of rolling mill gears is much higher than formerly, 50 per cent of the pinions being heat-treated.

There has been a good export business in high-class reduction gears in large units for mining, oil-well, and steel mill equipment.

Locomotive Business Promises Improvement

Present indications are that the locomotive business will increase from 5 to 10 per cent in volume in 1927, as compared with 1926. This would make 1927 equal to 1924, which may be considered a "normal" production year. The locomotive business in 1927 will depend to a great extent upon the continued prosperity of the railroads, which is assured if general business conditions continue on their present level. This, in turn, would also mean that the railroads would require new locomotive equipment to handle the large volume of traffic that would be offered to them. The development of the internal-combustion Diesel engine and the three-cylinder steam engine are new features in this field, which offer a replacement business of some importance where old-type steam engines are being replaced by them.

The Machine Tool Industry

The conditions in the machine tool industry are reviewed by a number of manufacturers in this field on pages 329 to 334 of this number of MACHINERY. In the past year the volume of business has varied considerably in different shops, but on an average, it has been about 10 per cent in excess of the business in 1925. The business of some machine tool builders has been as much as 40 per cent better than last year, but they question whether the coming year will be quite so good. The business will be considerably helped by the tendency of manufacturers, particularly in the automotive field, to replace old equipment with machine tools having the latest improvements, especially automatic and semi-automatic features, which in the production field reduce the work of the operator and increase output. The export trade has improved considerably, and accounts for a larger share of the total machine tool production than for several years. In a number of instances, it runs as high as 15 to 25 per cent of the total output of the manufacturer. The tendency toward greater stabilization in Europe will help to increase these percentages.

Summary of Machinery's Survey

If a summary is made of the statements in the present article relating to different industries, it will be found that the prediction of a year ago, that 1926 would be a banner year, has proved to be correct, the business in 1926 having averaged from 10 to 15 per cent above that of 1925. The prospects for 1927 are for a steady, healthy business—in some fields possibly 5 or 10 per cent less than in the peak year just ended; in some fields, approximately the same volume of business; and in others, slightly more. Manufacturers in general appreciate the fact that we cannot expect to continue to increase business by large percentages every year, and a slight recession in the total volume, of 5 per cent or less, would not be unexpected, nor would it cause any serious concern. Generally speaking, business is in an unusually healthy state, with every prospect that it will remain so during the coming year.

The Mining Machinery Industry

In the mining machinery field, 1926 was a much better year than 1925—approximately 15 per cent—the improvements being both in the coal and the metal mining branches. There is nothing disturbing in the prospects for 1927, and it is likely that it will prove as good a year as 1926 in this field, in some branches even better. The demand for coal mining machinery will probably increase, especially for equipment for the mechanical loading of coal underground.

The foreign demand is growing, and will increase still further with better financial conditions abroad. England, Italy, Spain, Russia, and Japan are among the active buyers of mining equipment.

Paper and Pulp Mill Machinery

From the sources from which information has been obtained, it appears that the volume of business in this industry in 1926 has been from 10 to 15 per cent greater than in 1925, but it is not expected that there will be quite so large a volume in 1927. Probably there will be a decline, possibly about 5 per cent.

Power Plant Machinery and Equipment

In power plant equipment generally, the business in 1926 has been very good. The demand for steam turbines has exceeded that of the previous year by an appreciable amount, and in this field there is every indication that business will increase further next year. The steam specialty business has also shown an improvement of at least 10 per cent, with prospects of another 10 or 15 per cent increase during the coming year.

Large gas and oil engine units have been in increasing demand, one leading builder reporting an increase of 25 per cent and expecting about the same volume of business in 1927. In smaller gas and gasoline engine units, there has not generally been the same increase in business, except in unusual instances. The stationary farm gas engine business, for example, has decreased considerably during the last few years on account of the growing use of tractors and the increased distribution of high-tension electric lines.

The demand for hydraulic turbines was not so great last year as in 1925, some leading concerns mentioning that in this particular line, the volume has been reduced from 25 to 35 per cent. The prospects for the coming year are that a business equal to that of 1925 may be contracted for.

In the power transmission machinery field, the volume of business during the last two years has remained practically unchanged, and a slightly reduced volume in 1927 would seem possible; even so, the prospective business is considered satisfactory.

Power Presses and Pressed-metal Products

In the power press field, there has been a considerable variation in the business reported by different builders. In one instance, the volume of business has been as much as 15 per cent below the 1925 figure; in another, 5 per cent below; while still other manufacturers have experienced an increase of from 5 to 15 per cent. The prospects for the coming year seem fairly satisfactory, the average opinion being that the volume will be approximately the same as in 1926.

In the pressed-metal products field, the volume of business has been very good, most manufacturers reporting a 25 per cent increase over 1925, an increase which most of them expect that they will be able to hold during the coming year.

Machinery for the Publishing Industry

The various lines of machinery used in the publishing field—printing presses, bookbinders' machinery, paper-feeding machines, etc.—have experienced an increase in volume of business in 1926 averaging from 10 to 15 per cent. On the whole, a volume of business similar to that of the past year is expected during 1927—and in a few instances, a material increase.

Pumps and Pumping Equipment

An increase of from 5 to 10 per cent is reported by most manufacturers in the pump field, one concern, only, reporting a decrease of 3 per cent. The outlook for 1927 is that business will be as good as 1926, or from 5 to 10 per cent better. The continued activity in the power plant equipment field, in general, makes the outlook for the pump industry, as a whole, quite satisfactory.

Rolling Mill Equipment

There has been considerable activity during the last two years in steel mill equipment, and most manufacturers of this line of machinery have had a steady volume of business both in 1925 and 1926. The steel mills have replaced a great deal of obsolete equipment, and several new developments have also added to the business. From present indications, it does not seem as if business in 1927 would be quite as large as during the two preceding years, but the reduction is expected to be less than 10 per cent.

Saw Mill Machinery

Most manufacturers of saw mill equipment have had approximately the same volume of business in 1926 as in 1925. In exceptional cases, the volume has been either appreciably less or considerably more. For example, one manufacturer reports a 20 per cent reduction, and another a 50 per cent increase. It is believed that business next year will approximately equal that of 1926, although it is likely to be affected to some extent by the possibility of a decline in building activity during 1927, as compared with the two previous unusually active years.

Shipbuilding

It is difficult to anticipate very far in advance what may be expected in the shipbuilding business. At present it appears that 1927 should show about the same gross business as 1926. On the Atlantic seaboard, the dry dock business has been about the same for two years, and there is every reason to believe that it will remain at about the same level during the coming year.

Small Tools and Tooling Equipment

Manufacturers of twist drills and reamers state that their business in 1926 has been from 10 to 20 per cent greater than in 1925. It is not generally expected that 1927 will be quite so good a year, manufacturers looking forward to a business more nearly equal to 1925. In taps and dies, business has been approximately 10 per cent greater than in 1925, with the expectation that it will be at least as good, or somewhat better, during the coming year. Probably the industry as a whole is running at about 75 per cent of capacity, although the volume of business at the present time is considered satisfactory.

The export business has held up unusually well, running in some cases up to 20 per cent of the total output. One leading manufacturer of taps and dies states that there is more demand for tools of greater precision and endurance than at any previous period. The demand for high-speed steel taps, both ground and unground, is increasing. The insistence upon tools of greater accuracy forces manufacturers of small tools to adopt methods that will meet this demand, requiring greater investment in the industry and a higher market price for the product.

In the tool equipment field—dies, jigs, and fixtures—several leading manufacturers report business from 7 to 33 per cent greater than in 1925. Those whose increase has been more moderate expect to hold a similar business in 1927, while those who have had an unusually big year in 1926 would not be surprised if, in their individual cases, business would fall off 5 or 10 per cent.

Textile Machinery—Woodworking Machinery

The textile machinery field is reviewed in a special article on page 336 of this number of MACHINERY; 1926 has not been a very good year, but an increased volume of business is expected in 1927, variously estimated up to about 15 per cent.

The woodworking machinery industry is reviewed on page 338 of this number of MACHINERY. It is expected that 1927 will be a good year.

Miscellaneous Branches of the Industry

A manufacturer of gas furnaces states that the 1926 business has been 25 per cent in excess of 1925, and that a 20 per cent increase over 1926 may well be expected in 1927, because of the new applications that are constantly being found for the gas furnace and gas heating appliance industry.

A manufacturer of machinery for bottling plants states that there has been an increase of 10 per cent in this business in 1926, and that present indications are that there will be an additional increase of 5 per cent over 1926 during the coming year.

A maker of crushing, grinding, pulverizing, screening, mixing, and weighing machinery states that the 1926 volume was 10 per cent less than that for 1925, but that an increase of 10 per cent over the past year is expected for 1927. The cotton situation has accounted for the falling off of business in this branch during the present year.

The 1927 Outlook in the Machinery Industries

Continued good business is the unanimous prediction of hundreds of executives

The volume of sales in the machine-building industries during 1926 was more nearly normal than for any year since 1913; and according to the opinions of leading executives in these industries, quoted in this number of MACHINERY, 1927 will continue a year of steady, evenly balanced business. There is not a single opinion to the contrary.

This unanimity does not indicate that in every branch of the machinery industry the volume of 1927 business is expected to be larger than in 1926, or even as large; because in several lines in 1926 sales reached a peak, but without any attendant conditions that so frequently precede a depression. 1926 was characterized by an absence of boom conditions—excessive price increases, reckless buying for stock, and abuse of credit.

1927 will begin with stable, and often very low, prices; and inventories usually down to cover actual requirements. Employment generally is at wages that have not been excessively increased, but maintain a favorable ratio to the cost of living, producing increased buying power by the masses. The absence of labor disturbances in the machinery industries during 1926 not only has maintained labor's purchasing power, but 1927 finds manufacturers with well equipped organizations.

The automobile industry, one of the largest employers of labor and which provides the greatest market for machine tools and shop equipment, is in a healthy condition. It is believed, both by men occupying responsible positions within that industry and by keen observers in others, that the output of automobiles, trucks and buses in 1927 will equal that of 1926. The domestic demand for passenger automobiles may fall off slightly, but there is every indication that the demand will increase for trucks and buses in the domestic market and for passenger cars and trucks in the foreign market. The importance of the export trade in the automotive field should be emphasized. It has grown steadily for the past five years until in 1926 nearly 400,000 cars and trucks were exported.

The steel industry—the biggest buyer of heavy metal-working equipment—is actively in the market. The cost of production continues to be reduced and efficiency increased in this field by scrapping old rolling mills and other steel mill equipment and replacing them with heavier and more modern designs. Entirely new methods and practices have been developed, especially in the sheet metal field, which require large purchases of new equipment.

The extent to which the railroads will buy machine tools is always problematical, but those in close contact with them expect a larger volume of machine tool purchases and rolling stock during the first six months of 1927 than for any similar period in recent years. The financial conditions of most roads resulting from the largest freight traffic in their history warrant this expectation.

Electric light and power companies are constantly enlarging their plant facilities to provide for the increased uses of electricity for industrial and domestic purposes, which means more business for the big electrical companies, and in turn, for manufacturers of machine-shop equipment.

The year just closed has not been a satisfactory one for the textile machinery industry, but indications are more favorable for 1927, and the demand for textile machinery is expected to improve. The prospects are not as favorable as a year ago in the farm machinery and agricultural implement industry, where less business is looked for than in 1926; but improved crop prospects in the spring may change these conditions. The farm tractor business promises to continue good during 1927.

To summarize—the opinions expressed by industrial leaders in this number of MACHINERY indicate for 1927 a year of good, steady business in the machine-building industries. In some sales will be increased, in others they may be curtailed; but all indications are that the aggregate volume will equal if it does not exceed 1926—recognized by all as a very satisfactory business year.

This survey of business conditions for next year is intended to apply only to the machinery industries. Readers of the daily papers are familiar with general conditions of business, which indicate a prosperous year for 1927.

Machinery's Prediction Last Year

(Published January, 1926)

Taking an average of all industries in the machine-building and metal-working fields, the expectations are that 1926 will be a banner year, with an increase in business of from 10 to 15 per cent above 1925. This does not mean that there will be a boom. Booms are not wanted, but a steady, healthy, growing business — and every indication at the present time points to that kind of business in 1926. Over-production and undue increases in prices in some industries, especially in materials, are looked upon as the only dangerous factors.

To you who read this line—MACHINERY wishes good health, happiness and prosperity for 1927.

Systematic Control of Production

How Work is Effectively Routed Through a Large Plant Building Woodworking Machinery

By CHARLES O. HERB

FIVE hundred or more different woodworking machines requiring a total of over 700,000 parts are built by the J. A. Fay & Egan Co., Cincinnati, Ohio. The machines are generally built in lots of from two to twenty-four, but many parts have been so standardized that they can be ordered in lots ranging from 50 to 20,000.

With such a large variety of machines and volume of parts, production problems would be complex were it not for the efficient production control system installed in the plant within the last few years. Even with the large number of different parts and an average of 800 shop employes, only six men are required to route all work and keep records up to date in both the production and casting departments. Two of these men are tracers, who keep a check on the progress of the work. This article will explain the more important fea-

LOT NO. | PART NO.

NO. OF PCS. | MATERIAL | ROUGH SIZES DIA. X LENGTH

NAME OF PART

NAME OF MACHINE | DATE STARTED

RAW MATERIAL REQUISITION AND RECEIPT

MATERIAL ISSUED BY | DATE ISSUED

SIGN HERE

PHYSICAL BALANCE IN STOCK AFTER THIS ISSUE IN ALL LOCATIONS | WT. PER PC. lbs.

MATERIAL RECEIVED BY | DEPT. | DATE RECEIVED

SIGN HERE

MATERIAL CARDS | SCHEDULE CHARTS | COST DEPT.

YOU ARE AIDING PRODUCTION, WHEN YOU FOLLOW INSTRUCTIONS
USE PINK FORM P-16 TO MOVE WORK FROM VISE DEPARTMENTS
— NOT THIS FORM —

FORM P-4 50M-1-25 A. S. B. Co. J. A. FAY & EGAN CO.

Fig. 1. Requisition Made Out for Castings and Bar Stock in Accordance with the Requisitions Filled in by the Assembly Foremen

LOT NO. | PART NO.

NO. OF PCS. | MATERIAL | ROUGH SIZES DIA. X LENGTH

NAME OF PART

NAME OF MACHINE | DATE STARTED

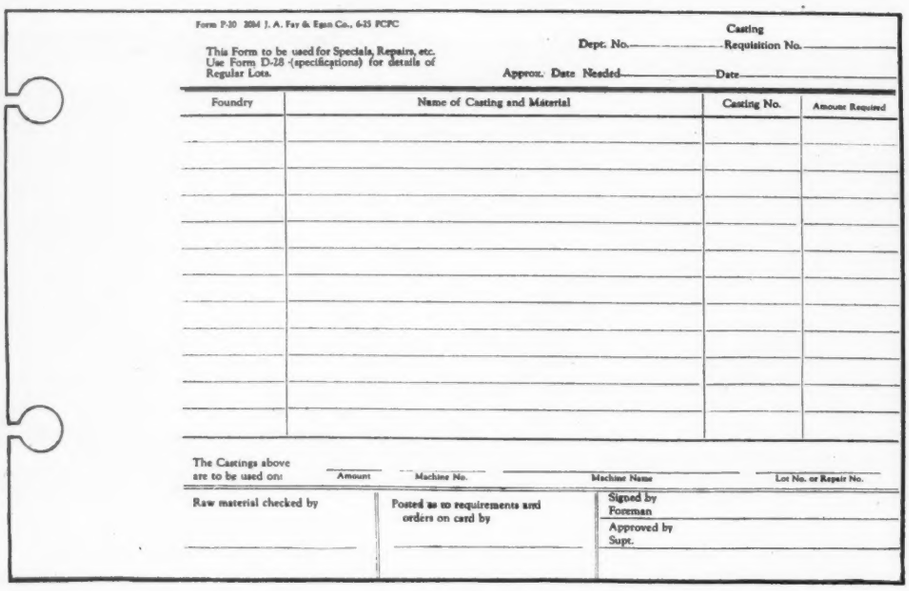
OP. NO.	DEPT. NO.	OPERATIONS
1		
2		
3		
4		
5		
6		
7		
8		
9		

WHEN FINISHED
DELIVER TO DEPT. NO.

J. A. Fay & Egan Co. KEEP TAG ON JOB

FORM P-5 50M-4-25 USE ORIGINAL TAG FOR ALL OPERATIONS

Fig. 2. Routing Tag which Accompanies Castings and Bar Stock from the Time They Enter the Shop until They Are Finished



Form P-30 20M J. A. Fay & Egan Co., 6-25 PCPC

This Form to be used for Specials, Repairs, etc. Use Form D-28 (specifications) for details of Regular Lots.

Dept. No. _____ Casting Requisition No. _____

Approx. Date Needed _____ Date _____

Foundry	Name of Casting and Material	Casting No.	Amount Required

The Castings above are to be used on: Amount _____ Machine No. _____ Machine Name _____ Lot No. or Repair No. _____

Raw material checked by _____

Posted as to requirements and orders on card by _____

Signed by Foreman _____

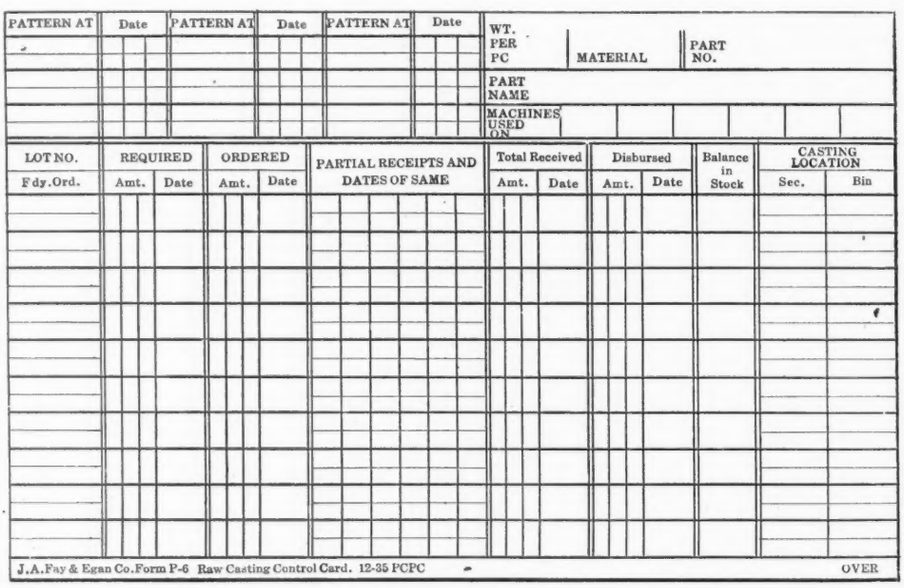
Approved by Supt. _____

Fig. 3. Requisition Made Out for Castings by the Fifteen Assembly Foremen

tures of the system and illustrate some of the forms used.

When a machine is sold, a sales order is issued on the shop by the sales department. One copy of this order goes to the production office and one to each assembly foreman concerned. In the production office, the order is entered on the production board shown in Fig. 10, copies of which are issued monthly to every department in the shop. Immediately to the right of the name of each machine entered on this board, there are three columns in which are recorded the number of machines sold, the number in stock, and the number ordered to be built.

To the right of these three columns follow other columns relating to each machining department in which work may be required on the machines or unit ordered. Each one of the blocks apportioned to a department is divided into four small squares. A dot is placed in one of these smaller blocks by the production manager when 25 per cent of the work required on the unit by the respective machining department has been completed. Hence, when

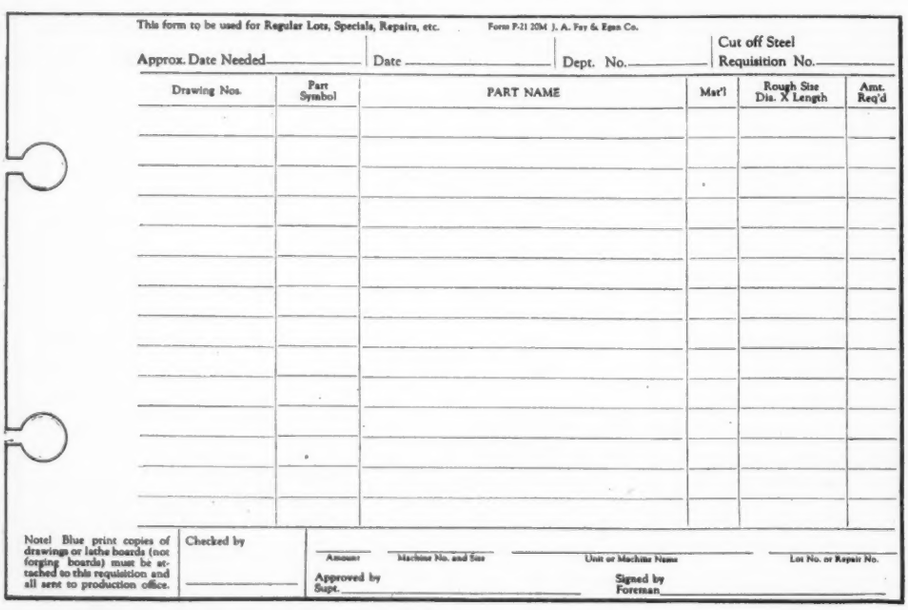


PATTERN AT	Date	PATTERN AT	Date	PATTERN AT	Date	WT. PER PC	MATERIAL	PART NO.
						PART NAME		
						MACHINES USED ON		

LOT NO.	REQUIRED		ORDERED		PARTIAL RECEIPTS AND DATES OF SAME	Total Received		Disbursed		Balance in Stock	CASTING LOCATION	
Fdy. Ord.	Amt.	Date	Amt.	Date		Amt.	Date	Amt.	Date		Sec.	Bin

J.A. Fay & Egan Co. Form P-6 Raw Casting Control Card. 12-35 PCPC OVER

Fig. 5. Card on which a Record is Kept of All Castings Ordered, on Hand, etc.



This form to be used for Regular Lots, Specials, Repairs, etc. Form P-21 20M J. A. Fay & Egan Co.

Approx. Date Needed _____ Date _____ Dept. No. _____ Cut off Steel Requisition No. _____

Drawing Nos.	Part Symbol	PART NAME	Mat'l	Rough Size Dia. X Length	Amt. Req'd

Note! Blue print copies of drawings or lathe boards (not forging boards) must be attached to this requisition and all sent to production office.

Checked by _____

Amount _____ Machine No. and Size _____ Unit or Machine Name _____ Lot No. or Repair No. _____

Approved by Supt. _____

Signed by Foreman _____

Fig. 4. White Slip on which Assembly Foremen Make Out Requisitions for Bar Stock

there are four dots in any large block, they indicate that the work has been completed in the department to which the block refers. When no work is required on a unit by any machining department, a small circle is drawn in the block, as shown.

The number of machines ordered in any lot can be quickly ascertained by reference to the production boards, and they immediately show how nearly finished any group of machines is. They also indicate whether or not a lot of machines must be started through the shop to cover a new sales order. The production manager

personally keeps these production boards checked up, so that he may keep his fingers on the "pulse of production."

Assembly Foremen Requisition Castings and Bar Stock

When a copy of the machine lot order issued by the production department reaches each assembly foreman, he obtains from the drawing-room a set of blueprinted specifications for the machine covered by the order, on which are listed all parts required for the machine. On these specifications, he enters the number of castings and bar-stock pieces of each part necessary to fill the order. He also checks on this list, the number of parts of each kind required for a machine, the materials from which the parts are to be made, etc. Castings are then ordered by the foreman on the form shown in Fig. 3, and bar stock, on the slip illustrated in Fig. 4. These two slips are then turned in to the production department. The prime reason for having the foremen make out these requisitions for materials, is to obtain a close check on the drafting-room specifications. In the production department, the requisitions made out by the foremen are also carefully checked to obviate errors.

As soon as a requisition for castings or bar stock reaches the production office, the raw material requisition and receipt slip shown in Fig. 1, and the routing tag illustrated in Fig. 2, are filled out. This slip and tag are clipped together, and as the upper half of the slip and tag are identical, this portion of the slip has carbon on the back so that both forms can be filled out at the same time. The information on the lower portion of the tag is filled out from the master routing card shown in Fig. 6, which is filed in the production office. The slip and tag shown in Figs. 1 and 2, respectively, are next sent, together with the original requisition made out by the foreman, to either the casting department or the bar stock room, depending upon whether castings or bar stock is asked for on the requisition.

When the slips, tag, and requisition reach the casting department, reference is made to the casting control cards of the casting department, one of which is shown in Fig. 5, to ascertain whether or not the desired castings are on hand. If they are, a clerk crosses out the item on the yellow requisition, and returns it to the production office, where the tracer marks his work-in-progress book accordingly and files the requisition. Both the slip and the routing tag shown in Figs. 1 and 2 are attached to the castings and sent with them to the first department listed on the routing tag.

Check No	Name of Workman	Mch. Dept. No.	Lot No.	Part No.
Oper. No.	Description of Operation		Kind of Job	No. Pcs.
Name of Part			Next Dept.	No. Pcs. Spoiled
Name of Machine				No. Pcs. Defective

TIME RECORD	ELAPSED TIME		Ondmd	A. O.
		FINISH		
		START		
		FINISH		
		START		
		FINISH		
		START		
		FINISH		
		START		
		FINISH		
		START		

Check No. | T. A. | T. M. | T. G. | Tot. O. T.

Scheduled to Start / /
Started / /
Scheduled to Finish / /
Finished / /

Time Lost
Std. Per Pc. Min.
Setting Min.

REMARKS-- (OVER)

J. A. Fay & Egan Co., Operation Order—Foreman's Copy—Used for Departmental Planning. Form P-7—1-1-25—100M. After Job is Finished Filed by Foreman as to Lot Nos.

Fig. 7. Part of Triplicate Time Ticket or Operation Order Filled Out by the Departmental Timekeepers for Every Operation on a Part

PART NAME						PART NO.
OP. NO.	DEPT. NO.	OPERATIONS	STD. PER PC.	SET UP	DAYS ROUTE	REMARKS
1						
2						
3						
4						
5						
6						
7						
8						
9						
WHEN FINISHED DELIVER TO DEPT. NO.			BY			MATERIAL / ROUGH SIZES

J. A. FAY & EGAN CO., FORM P-13-10M1--28 MASTER ROUTING RECORD

Fig. 6. Master Routing Record Maintained in the Production Office for Each Part Manufactured

CASTING DEPARTMENT

Castings Received from Foundry Date

Castings Put Away Date

Pattern No.	Amt. Rec'd	Foundry Order No.	Bal. Due	Amt. Sent to Shop	√ in Book	√ on Cards	Amount Put Away	LOCATION Sec.	LOCATION Bin	LOCATION Sec.	LOCATION Bin	Total Now in Bins

Castings Received by ..... Checked in Book by ..... Checked on Cards by ..... Put Away by .....

J. A. Fay & Egan Co. Form P-19, 10M-11-25 PC

Fig. 8. Daily Record Maintained in the Casting Department of the Receipt and Disposal of Castings

LOT No.	PART No.
NO. OF PCS.	MATERIAL / ROUGH SIZES
NAME OF PART	
NAME OF MACHINE	DATE

SPECIAL MOVE TICKET & RECEIPT.

MATERIAL SENT BY	FROM DEPT.	DATE SENT
SIGN HERE		
MATERIAL RECEIVED BY	TO DEPT.	DATE RECEIVED
RECEIPT HERE		

THIS FORM, P-16 TO BE USED TO MOVE WORK FROM VISE DEPTS. & OTHER DEPTS THAT DO NOT MAKE OUT THEIR TIME ON TRIPLICATE TIME TICKET. FORMS P- 7, 8 & 9 THE MATERIAL MUST ALSO HAVE ROUTING TAG FORM P-5 ATTACHED WHEN RECEIPTED THIS FORM TO BE TURNED OVER TO PRODUCTION OFFICE FOR CHECKING.

J. A. FAY & EGAN CO. P-16 6-4-24 10M

Fig. 9. Special Move Ticket and Receipt

When the castings called for are not on hand, the slip and tag are filed, according to the part number, with the casting control card shown in Fig. 5. The yellow requisition is then marked with the name of the foundry, to indicate that parts must be cast to fill the order. The requisition is then returned to the production office so that the tracer can mark the work-in-progress book to suit, after which it is sent to the purchasing department as authority to make the necessary order on the foundry. When this has been done, the purchasing department returns the requisition to the casting department, where the information is posted on the card shown in Fig. 5. Finally, the yellow requisition is returned to the production office for further reference.

The casting control card, Fig. 5, provides a convenient record of castings required, ordered, and on hand, and the location of castings in stock. The various columns of this card are continued down the back. The card is filed according to the part number. When the castings that have been ordered from the foundry arrive, the slip and tag shown in Figs. 1 and 2 are attached to them, and the castings are then sent to the first shop department listed on the tag. Heavy castings routed to planers, boring mills, etc., are not sent into the shop until requisitioned by the foreman of the department concerned and "OK'd" by the production manager. This is done to make sure that the right job is being sent into the shop. All bar stock leaving the stock-room to fill a requisition is also accompanied by the slip and routing tag shown in Figs. 1 and 2.

Operation Orders Made Out by Departmental Timekeepers

When an order of castings or bar stock reaches the first department listed on the routing tag, the foreman of that department signs the slip shown in Fig. 1 to acknowledge the receipt of the material, and then forwards this slip to the production office. The routing tag, however, remains attached to the parts during their entire journey through the various departments.

Work is always sent to the different departments in the sequence in which the departments are listed on the routing tag. Foremen are required to sign a receipt for the parts so as to insure that they are apprised of all jobs delivered to their departments

DEPT No. 2 — EACH DOT MEANS 25% PERCENT FINISHED

MACHINE	SOLD	ON HAND	BUILDING AMOUNT	BUILDING LOT No.	CASTING	PLANING	MILLING	STEEL CUT	FORGING	LATHE	KEEY MACHINE	DRILLING	CYLINDERS	WHEELS	PULLEYS	JOINTER BARS	NEXT AMOUNT	NEXT LOT No.	ALSO LOT ORDER FOR	DATE LAST CHECKED / REMARKS
*#155 Band Saw																				
#155 B. B. Unit																				
#155 Shifter Parts																				
*#345 Band Saw																				
#345 B.B. Unit																				
#345 Shifter Parts																				
#50 & #345 Tables																				
#436 Resaw Att.																				
*#50 Band Saw																				
#50 B. B. Unit																				
#50 Shifter Parts																				
*#50 L.H.Band Saw																				
*#58 Band Saw																				
#58 B.B. Units																				
#58 Shifter Parts																				
*#58 L.H.Band Saw																				
*#6 Band Saw																				
*#5 Band Saw																				
*#456 Band Saw																				
*#459 Band Saw																				
*#4 Scroll Saw																				
*#109 Band Rip Saw																				
*#146 Rip & Resaw																				
Radius Attachment																				
Resaw Att.-O. S.																				
Cir.Cut Attachment																				
Dbl.Slotted Fence																				
Pattern Shop Att.																				

Fig. 10. Production Board Maintained by the Production Manager

and also to guard against work being delivered to the wrong departments.

The timekeeper of the department makes out three slips for every operation required in his department on a given lot of parts. These slips are printed together with carbon on the back of two of them, so that they can be made out in triplicate. Two of the slips are duplicates of that shown in Fig. 7, on which A. O. means "Actual Over-time"; T. A., "Time All"; T. M., "Time Made"; T. G., "Time Gained" and Tot. O. T., "Total Over-time."

One of these slips is given to the foreman of the department for use in planning the work through the department. It is filed by him according to the operator or the machine on which he decides the work should be done. The second duplicate slip is used by the timekeeper. When a man starts on an operation, the timekeeper stamps the three slips by means of the time-clock, and writes in the name and number of the operator and other pertinent information. When the man completes the operation, the stopping time is stamped on all three slips, and the time made and gained is figured and written on two of the slips. The foreman's copy is then filed under the lot number and the machine, as a job done, while the duplicate of this slip is sent to the time and cost department.

The third slip differs from the other two in that some of the columns intended for data relating to the machining time of the job are replaced by columns in which the name of the inspector and the date when the parts are inspected are written. This slip also serves as a move ticket to forward the work to the next department listed on the routing tag. It is signed and dated by that department when the parts arrive, and is then sent to the production office for checking the progress of units and filing. By filing these slips, the production office maintains an accurate record of the department in which the work may be at any time.

As a job reaches the subsequent departments listed on the routing tag, each department timekeeper makes out three slips of the form shown in Fig. 7 to be used in the same way as in the first department. When the final machining department completes all operations, the parts are sent with the routing tag still attached to storage, where they are held until they are needed on assembly floors. The assembly foremen make out the special move ticket and receipt slip illustrated in Fig. 9 when they want to send a job to a machining department after an assembly or lay-out operation in their departments.

The Use of Colored Tags and Slips

The slips shown in Figs. 1, 2, 7, and 9 are printed in five different colors to distinguish the different classes of work and indicate the degree to which the job should be expedited through the shop. The departmental timekeepers make out the triplicate slip shown in Fig. 7 according to the color of the original routing tag made out in the production office, while the assembly foremen make out the slip illustrated in Fig. 9 according to their own requirements. When the routing tag or one of the slips mentioned is made out on white, the indication is that the parts to which the tag or slip refers are to be used for regular or rebuilt machines, and are not to be rushed through the shop. These orders can be placed in the "rush" class at any time.

Green forms are used for all special work on regular machines, such as motor bases and special parts that are usually "rush" jobs. Slips of the same color are used for such jobs as patching up work. Yellow slips are used for parts that are to replace spoiled or broken work and defective castings. Such parts are usually required for a job run through the shop during the preceding week or month, and must be rushed in order to catch up with the rest of the lot. Pink slips are used for repair parts required on customers' machines, which are needed in a great hurry. These parts have preference over all others, except parts being made to replace pieces taken from a regular lot to take care of a customer's needs. Blue tags are placed on all regular work that is to be rushed with all possible speed from the time that the work is ordered until it has been completed. These tags are used only at the discretion of the production manager.

Records of the Casting Department

The records of the casting department form an important link in this production system. Before the system was inaugurated, castings were ordered more or less haphazardly, because, it was never known just how many castings of a given kind were on hand. Frequently the wrong castings were ordered for a job. One of the advantages of the control card illustrated in Fig. 5 is that one card can be used for twenty different lots of the same part. In addition to the information relating to castings, this card shows the location of the pattern from which the part is cast, in any one of fifteen foundries.

Various other records are maintained in the casting department to carry on the work of the department efficiently. There is the receiving sheet illustrated in Fig. 8, on which are entered items concerning the receipt and disposal of castings. This sheet and the requisition serve as a check on the control card. Whenever castings are placed in a bin or taken out on requisition, the number on hand is counted and verified against the number given on the control card, thus affording a continuous physical inventory. When an order is made out on a foundry by the purchasing department, two duplicate copies are sent to the casting department, and one of these is kept on file. The other slip is given to the pattern man who visits the foundries. A similar copy of the purchase order is sent to the production office for reference. When patterns are sent to the foundry, a shipping slip accompanies them, and this slip must be receipted and returned to the casting department when the pattern reaches the foundry.

* * *

According to a paper read by W. E. Wheat before the American Society of Civil Engineers, there is danger of lightning striking and damaging concrete highways, the danger lying in the metallic reinforcement that is used. In one case where lightning struck a roadway, the current jumped in both directions for a distance of about 700 feet, leaping from one reinforcement rod to the next.

The Riveting and Welding Processes

THAT the riveting process and the welding process each has its own broad field of application is well known. There are, however, differences of opinion regarding the relative merits of these processes as applied to certain classes of work. In an address by A. F. Jensen, president of the Hanna Engineering Works, Chicago, Ill., before the annual convention of the American Institute of Steel Construction, various points relating to this general subject were discussed, such, for example, as the dependability of riveting, the accuracy of available data concerning it, and the importance of basing comparisons of costs or quality of work obtained by riveting and welding upon actual working conditions.

"Claims of lower costs and superiority of product," said Mr. Jensen, "must be demonstrated by actual performance of plant and equipment wherein welding is used for joining plates, shapes, bars, etc., of the type constituting the nation's tonnage. Whether the welding of structural steel members holds advantages over the riveted structure can only be determined by undertaking its fabrication on an everyday commercial basis.

"In seeking information on the dependability of welding, one naturally turns to the industry with experience in that process. Extensive data on both riveting and welding have been accumulated by the Bureau of Locomotive Inspection of the Interstate Commerce Commission, and we quote the following from an informal talk by A. G. Pack, which appeared in the April 26, 1926, issue of *The Daily Metal Trade*, reporting the annual meeting of the American Welding Society:

Another expression on the inadequacy of the present information on welding was voiced by A. G. Pack, chief inspector of locomotives, Interstate Commerce Commission. He said that the use of welding has not had uniform results on the railroads of the country. . . . Mr. Pack thought that until he could feel sure that welding is safe, and that the safety of the weld is something that does not depend entirely on the training and skill of each individual welder, he could not conscientiously encourage welding in connection with locomotive repairs.

Welding as Applied to Boilers

"The following quotation is from an address by Mr. Pack, made before the Traveling Engineers' Association in Chicago, and relates to an analysis of certain failures.

Boiler barrel: Circumferential cracks developed in the solid plate at the edge of welding which had been applied to seal the calking edge of circumferential seams. Of five similar boilers treated in this manner three failed to such an extent that they could no longer be used; the remaining two were then retired from service in order to prevent the possibility of further trouble.

Boiler back head: Fusion welded crack in back head failed. Failure occurred while the locomotive was hauling a passenger train at an estimated speed of thirty-five miles per hour.

I do not desire to be understood as opposing fusion welding when properly and discreetly used, and believe that it has a very wide and useful field. If we are to profit by the experiences of others, we must give careful consideration to the result of all practices and methods. The extreme to which fusion welding has been carried is what I have taken exception to. It is not a cure-all, nor can it be used indiscriminately with safety, nor even economy.

"*The Locomotive*, the house organ of the Hartford Boiler Inspection & Insurance Co., has from time to time presented data on explosions attributable to welding. The following quotation is from a recent issue:

This accident again emphasizes the unreliability of autogenously welded joints for pressure vessels; and it also shows the inadvisability of testing new vessels by air pressure, even at as low a pressure as 15 pounds. A riveted joint may be inspected and reasonable assurance of its soundness thereby obtained. Not so, however, with a welded joint, as the external appearance does not give a true indication of its soundness.

"An article in the July, 1925, issue of *The Locomotive*, entitled 'Some After Effects of Welding on Boilers,' contained the following reference to boiler repair work:

Eight years ago a battery of five boilers, all of which were made by a prominent and reliable manufacturer, developed chronic leaks along the girth seams. It was thought that sealing by welding would most readily solve the problem, and so an acetylene welder was called in. This did not remedy the trouble permanently, however, and shortly after more welding was done, this time by the electric arc method. All five boilers were effectually sealed by more or less of this treatment and gave practically eight years of service without any serious interruptions.

Recently the night watchman at the plant reported having heard a distinct report in the boiler room, but was unable to locate anything wrong. The next day, one of the firemen reported having heard a similar noise. Later on the same day, upon getting up a few pounds pressure in a boiler that had lain cold, the cause of the mysterious noise was revealed. A circumferential crack was discovered in the solid plate right at the edges of the added metal on the first girth seam. At first, it was believed to be a short crack, about 12 inches long, and subject to patching, but it was found upon investigation to extend so far around that the boiler was immediately condemned.

Realizing that the other four boilers had been treated in a like manner at the same time, some concern was felt for their safety. Internal stresses such as had ruptured the first boiler might also be present in the others, yet there was no ready way of determining this. While the question was still being debated, it was suddenly settled in a decisive manner. Within a month, two of the other boilers suffered a like failure, and under almost exactly the same conditions. Eight years of service had not removed the strains of localized heating and cooling.

"An article entitled 'Are Welded Pressure Tanks Safe,' by John S. Spicer, chief of the accident investigation section, Bureau of Inspection, Pennsylvania Department of Labor and Industry, appeared in the November, 1925, issue of *The Boiler Maker*. Several failures of welded air receivers are described, and then the statement is made that 'within recent years the Department of Labor and Industry has not heard of the failure of a riveted tank when used for similar purposes under similar conditions.'"

Ductility and Fatigue Resistance

Mr. Jensen pointed out that ductility is the first element to be considered in steel where fatigue resistance is a factor. "Metallurgists," he said,

"have plotted curves which show that the length of life decreases as brittleness increases. Recent fatigue tests indicate that a corroded or oxidized surface contributes to the development of fractures. Many of the defects which frequently appear in the cast metal in a weld, such as gas pockets, slag, and oxide inclusions, lack of fusion, stratification or layers, seams, and cracks, are such as will hasten fatigue failure. The normalized steel of a rivet is far superior to the metal in a weld cross-section in respect to fatigue. Structural engineers will welcome the results of fatigue tests upon representative welded joints where the intensity and number of load applications are given.

"Many riveted joints are made where conformity in design with good theory is impossible, and the rivet is, therefore, liable to work loose. A properly designed riveted joint will not move unless the stress far exceeds that for which it was designed. Testing by tapping discloses a rivet that does not grip the plates even though the rivet fills the hole. Rivets that will not pass the tapping test may be tightened by striking them again with the riveter, even though the rivets be cold. Such rivets are usually stitching rivets through heavy grips, all of which proves that the frictional value of plate upon plate is a real, definite factor. Welding seems to offer no way of obtaining this frictional value. Any attempt to analyze the action of a riveted joint by the observance of a joint made of rubber is misleading. To attack the dependability of a riveted joint is to question the intelligence and the experience of the steel construction industry. The gradual deterioration (and it is decidedly gradual) of a riveted joint will give forewarning of its deterioration long before actual failure, whereas a weld will give no warning whatsoever, nor is its failure gradual.

Machine-driven Rivets

"Approximately 150 rivets are required per ton of structural steel. Machine-driven rivets predominate. Every stroke of the compression yoke riveter sets the rivet with a predetermined tonnage, produced irrespective of the judgment and skill of the operator and with the certainty that sufficient pressure has been exerted on each rivet. A machine-driven rivet always fills the hole. The upsetting or forming of the head requires such intense pressure per square inch of head cross-section that the hole must be completely filled before the rivet metal therein can resist this head-forming pressure. A filled hole is only one of the essentials of a properly driven rivet, as a rivet which fills the hole but which does not grip the plates will be rejected. Compression riveter operators drive rivets that grip the plates firmly, because a simple inspection will surely disclose rivets that are otherwise .... A burned rivet can be identified by appearance, and a loose rivet by tapping. The operator of a riveter need only take care that the rivet temperature is within a range of 500 degrees F., and the machine will take care of the rest. Prevention against burned rivets is more a matter of provision of proper heating devices than care upon the part of the rivet heater. Because of the human factor in welding, no weld is better than the welder.

"In all the data on structural welding which I have read, it is obvious that the welder knew the weld was for test purposes. The most skilled and conscientious welders have been employed; supervision has been close and comprehensive, and the conditions have been test conditions, all of which will not prevail on mass production. Methods and machinery used in riveting have practically eliminated the necessity for skilled workmen. Industry's greatest problem today is that of man-power and it is, therefore, but a logical conclusion that those qualified by experience in the problem of the fabricating shop should consider the importance of the human element in welding as paramount....

"One of the great advantages of riveting is in the aligning and locating value of the matched rivet holes. They predetermine the squareness of the structure, irrespective of the erectors. Rivet holes are located in the shop, where their accuracy may be established with certainty and economy and with the assurance that the discriminating plans of the designing engineer are conformed to in the field.... A considerable item of cost not incurred in riveting, but necessary when welding, is that beams must be machined to exact length and the ends squared. Then, too, considerable additional drawing expense will be incurred by erection drawings essential when welding."

Future Developments

Regarding future developments, Mr. Jensen said: "To compare possible future developments of welding with riveting practice as it now exists is to assume that the riveting art is at a standstill—an assumption not justified. In the riveting art, we may look forward to the introduction of portable yoke riveters, much lighter than the machines now in use, alloy steel rivets, the acceptance of cold-riveting, power-actuated mechanical devices for the manipulation of riveters on straight-run work whereby the bucker-up is eliminated and the operator controls two or more riveters merely by the manipulation of valves making it possible for a crew of four men to drive at least fifty rivets per minute, and the introduction of multiple riveting machines which will drive at least a dozen rivets for each operation cycle. A combination of cold-riveting and multiple riveters constitutes the most promising possibility for the reduction of structural steel fabricating costs."

In conclusion, Mr. Jensen referred to the field of usefulness for both welding and riveting, but emphasized the dependability of riveting and its contribution to engineering progress. "Riveting is fundamentally sound, has played a very important part in the development of our most important industries, and will only be supplanted by methods more economical, less dependent on skilled labor, and assuring equal safety."

* * *

Los Angeles is said to be the "patent center" of the United States, as more patents per capita of population are granted annually to residents of this city and its immediate vicinity than to those of any similar section of the country. The Los Angeles Public Library now has a "Patents Room" containing patent files representing the largest collection west of the Mississippi, and consisting of United States', British, Canadian, German, and Cuban records.

Encouraging Employes to Make Suggestions

How a Large Electric Company Obtains Thousands of Valuable Suggestions, which Result in Lower Manufacturing Costs

By H. H. DINKINS, Jr.,
General Electric Co., Schenectady, N. Y.

FORTY-THOUSAND dollars, approximately, was awarded to employes of the General Electric Co. last year, for suggestions that led to the adoption of more efficient methods in shops and offices. From an average of about 55,000 employes, 11,325 suggestions were received last year, of which 3433 or 30.3 per cent were adopted. The vast majority of the suggestions came from machine operators and men termed "laborers." Awards of as much as $1000 have been made for one suggestion. This article will describe a number of typical suggestions and explain the system by means of which they are encouraged, investigated, and disposed.

An award of $300 was made for an idea that led to a new method of milling the copper end rings of induction motors. In the new method, use is made of a fixture on which two rings can be clamped on opposite sides of the milling cutter, when the fixture is mounted on the table of a hand milling machine. The rings are fed alternately to the cutter by operating a hand-lever, and are automatically indexed between each feeding movement until the entire series of teeth has been milled in both rings.

Other Suggestions that Effected Substantial Savings

Another suggestor devised a spiral method of applying cotton insulation to small sizes of wire. This resulted in an improved product, with less labor and lower cost. The man who originated the idea was awarded $100 by the suggestion committee.

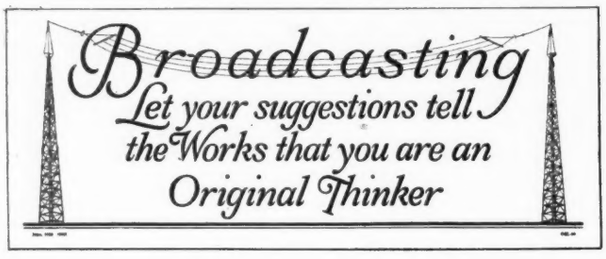
One man suggested that an additional solution tank be added to the equipment used for treating canvas duck with bakelite, and also recommended alterations in the machines used, making it possible to run two reels of duck simultaneously through what had previously been a single-roll machine. These improvements greatly increased production, rendered the installation of new machinery unnecessary, and effected an economy in steam consumption. In this case, the man who made the suggestion was awarded $100.

An inspector in the wire and cable department thought out a simple way to avoid winding a small amount of untinned wire on a spool at the end of a tinning operation. Previously, the tinned wire had to be unwound from the spool in order to cut off the untinned portion, and then rewound on a second spool. The new method did not require any new machine devices but it saved much time and material, and so the suggestor was paid $250.

An award of $1000 was made to an employe who brought about an improvement in the method of putting insulation on high-tension cables. Another man submitted an idea for a friction chuck adapted to setting bolts and nuts and driving screws. Four sizes of this chuck have been adopted as standard equipment in the Schenectady Works and are also made up for use in the other plants. The suggestor was awarded the sum of $50 for the idea. This chuck is described on page 379 of this number of MACHINERY.

How Suggestions are Encouraged

The primary reason that the suggestion system is so successful in the plants of the General Electric Co. is that the management extends wholehearted support to the system. Men particularly suited for the work are chosen to serve on the suggestion committees, and these committees function in a businesslike manner. Meetings are held weekly, whether or not there is much business on hand, and constant effort is made to inspire the confidence of the employes in the decisions of the committees. The following outline of the system covers the general principles of all plants, but the details apply to the system used at the Schenectady Works.



Boxes of the type shown in Fig. 1 are installed at convenient points throughout the factory and offices to receive all communications intended for the suggestion committee. The boxes were first located in out-

of-the-way places on the supposition that employes would be sheepish about offering suggestions. This was found not to be the case, however, and so the boxes are now prominently placed near exits, time clocks, bulletin boards, and drinking fountains. One box is provided for approximately every 200 employes in the large plants, and for every 100 employes in the small plants. The box is mounted on a board that carries four racks—one large rack for displaying cards that advertise the suggestion system; one for envelopes addressed to the suggestion committee; one for cards requesting a personal interview, which is used by suggestors who cannot express themselves well in writing; and a fourth for a pad of blanks upon which suggestions may be written. The board on which the box is mounted is 18 inches wide.

The value of the advertising posters which are placed on the large rack of the boxes cannot be over-emphasized. These posters have been found so useful in stimulating interest in the suggestion system that a standardized service has been arranged to provide a monthly change of cards in all plants. An endeavor is made to avoid sermonizing and dry reading on these cards. Colored cardboard, catchy illustrations, and attractive type are resorted to. Two typical cards are illustrated on pages 344 and 346. A contest was recently held to obtain slogans for these cards. The slogan that won the first prize of $25 read as follows: "The World is Blessed Most by Men Who Do Things, Not by Those Who Merely Talk about Them. Be the Doing Kind. Hand in Your Suggestions." This was written by a shop man.

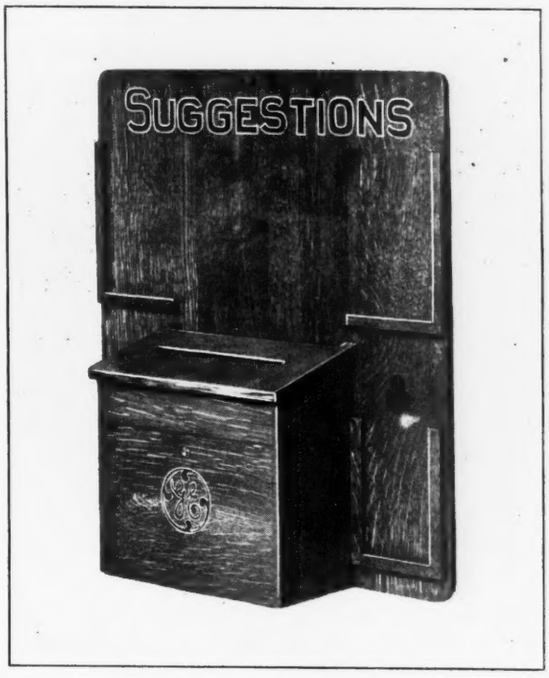


Fig. 1. Type of Box Placed Throughout Shops and Offices to Receive the Suggestions of Employes

The system is constantly advertised, in order to overcome prejudice, remove the opposition of supervisors, and, most of all, overcome inertia and indifference. The subject of advertising is not merely to secure suggestions but to secure good suggestions. Interest in the suggestion system is also maintained by publishing a Suggestion News Column in the works' papers and by occasional talks on the subject by company officials. Many of the suggestions that are made furnish the germ of an idea that can be developed into something worth while by the engineering department. The suggestor, of course, receives credit for having called the matter to the attention of the management.

Handling the Suggestions

Members of the patrol department make semi-weekly visits to the boxes to gather the suggestions, and these are turned over to the secretary of the suggestion committee. The secretary classifies them, and numbers them consecutively in the order in which they are received. Each suggestion is stamped with the date of its receipt, and is recorded by the number given to it, the name of the suggestor, and, sometimes, by the title of the suggestion. It is then referred to the department concerned.

The head of this department usually appoints a member of his staff to invesigate whether or not the suggestion is a practical one. This man always interviews the suggestor in order to make sure that he thoroughly understands the suggestion. He then makes a report to the suggestion committee in which he states whether or not the idea will be adopted, and gives the estimated annual saving that it will effect. If it is not possible to estimate the saving, the investigator recommends the amount of the award that should be paid.

When the report is received by the secretary of the suggestion committee, he refers it to one of the committee members for investigation. When this investigator agrees with the recommendation of the departmental investigator that a suggestion should be rejected, he disposes of the suggestion with great care, by a personal interview with the suggestor. Suggestions that both investigators agree should be adopted are brought by the committee investigator before the committee, with a full description of all details and a recommendation of the size of the award. When the committee investigator does not agree with the recommendation of the departmental investigator, the two get together and analyze the matter until one of them has been won over to the opinion of the other.

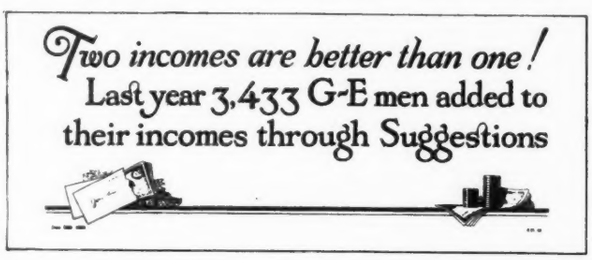
It will be appreciated that the ability and personality of the secretary and the investigators are important factors in the success of the system. A great deal of responsibility is placed upon them, because it is their duty to keep the employes satisfied and to inspire their confidence. Antagonism from some of the men in supervisory positions was experienced when the system was instituted, but this has been overcome largely by repeated declarations from the management that suggestions are desirable and regarded as an indication of the progressiveness of a department.

Whenever possible, the committee investigator obtains samples embodying the suggestion and savings figures from the cost department, since awards are always influenced by the estimated savings when these are determinable. Awards vary according to the ingenuity and effort required of the person who made the suggestion. Obviously, a man who effects a saving of several thousand dollars a year by suggesting the substitution of a punched part for a molded one, does not expend as much effort as one who, on his own time and at his own

expense, evolves an ingenious device on which production is small. The adoption of a suggestion or the granting of an award does not necessarily depend upon the originality of the idea. It does not have to be an invention or a startling innovation. The fact that not more than five of the suggestions made at the Schenectady plant in 1925 were patentable serves to illustrate this point. The suggestion may even have been made before, but through negligence on the part of supervisors, has not been applied wherever possible. Obviously impracticable suggestions are sometimes rejected by the secretary without being referred to the department concerned.

Personnel of Suggestion Committees

In addition to the secretary, the suggestion committee consists of a permanent chairman and four or more members, generally taken from the manufacturing organization. The manager and superintendent are usually members of the committee in the smaller plants, while in the larger plants, each is represented by members of his staff. Sometimes the chairmanship is rotated among the committee members. It has been found good practice to include on the committee a member familiar with electrical engineering, one familiar with electrical operation or testing, one skilled in mechanical design and machine shop practice, and a cost man who can determine savings. In plants where there is an employes' council, the employes are permitted to select representatives to act with the committee in passing upon suggestions.



Considerable importance is attached to the speed with which suggestions are handled, as best results follow when a suggestion can be completely disposed of within a month. In order to keep the time at a minimum, most committees meet each week on a specified day. The first business is to hear the secretary's report of suggestions received during the week, the number of suggestions on which the reports of investigators have been received, the number of suggestions awaiting investigation, and the number pending until the savings resulting from their adoption can be determined. Following this, the awards granted a year previously are reviewed to see whether suggestors received sufficient awards as determined by a year's operation. When it seems desirable, a supplementary award is granted to adjust the compensation to the proper value.

When complete information is available on pending suggestions, they are considered and awards determined for those that have been adopted. The committee then considers new suggestions that have been adopted, awarding sums according to their merits. The secretary is instructed to write to each suggestor whose idea has been accepted and ask him to appear at the committee meeting the following week to receive his award.

Making the Awards

At the end of each weekly committee meeting, the suggestors who were granted awards the preceding week, are called in, one at a time, and given their award in the form of a cash order, which is payable upon presentation to the cashier. Usually the committee member who investigated the suggestion makes the award, and as he does so, he endeavors to ascertain whether or not the suggestor is satisfied with the amount given him. Questions are tactfully put, and the suggestor is encouraged to continue his good work. In most cases, the suggestors are pleased with the award and with the recognition they have received, but in a few cases they are dissatisfied. Dissatisfied suggestors are assured of a further investigation and an adjustment of matters if the decision has been found unfair. Following the investigation, the suggestor is again interviewed by the committee and either granted an additional award or shown in detail why a larger compensation cannot be given. The practice of mailing checks to employes either at work or at home proved to be unpopular.

Correlating the Suggestions of All Plants

In order that the suggestion committees of all the General Electric plants may follow a standardized practice, a man in the manufacturing general department at Schenectady, serves as general secretary to the committees of all plants. This man keeps in close contact with the various committees through correspondence and personal visits. It is his duty to do the general advertising for the entire suggestion system and to assist individual committees out of difficulties.

All adopted suggestions that may be applied in other plants besides the one in which they originated are sent through the office of the general secretary to the other plants. In this way the greatest possible benefit is derived from all suggestions. Information concerning suggestions are sent to the various plants in the form of typewritten descriptions, photographs, and blueprints. When a suggestion is adopted in more than one plant, the suggestor is usually given an additional award.

The General Electric Co.'s experience with the suggestion system extends over a considerable number of years, and the company is convinced that the system is sound in theory and beneficial in practice, both to the men and the management. It is difficult to generalize in regard to a suggestion system, because of the many factors affecting its operation. However, one or two things must be borne in mind, if such a system is to operate successfully. First, there are few rules in regard to the operation of the system to which exception cannot be made, if conditions warrant it. Second, and most important of all, absolute justice is the life of the system.

* * *

STANDARDS FOR GALVANIZING

A committee has been organized under the auspices of the American Engineering Standards Committee to carry on the work of standardizing the quality of zinc coatings for iron and steel products.

Things You Should Know About Patents

By LEO T. PARKER, Attorney at Law, Cincinnati, Ohio

A UNITED STATES patent is a monopoly created by law. A patent is a written contract between an inventor and the government. The "consideration" given by the inventor to the government is his disclosure of the invention in plain and understandable language, so that any person who is skilled in the art to which the invention relates may make and benefit by the invention after the period of patent protection has expired.

The right to a patent monopoly originates solely from the laws of the United States, and, therefore, state laws cannot affect the benefits or advantages to be derived by the inventor, or the patent itself. Under various circumstances the states have attempted to regulate or vary the monopoly granted to a patentee, but the states have no power to interfere with federal laws.

Numerous decided cases establish that the United States Courts are favorable toward inventors who have meritorious inventions; and the rule is that all doubtful cases regarding infringements and validity of patents are decided in favor of the inventor. For example, in a quite recently decided case, the Court, in effect, said that the United States laws which guarantee an inventor the exclusive right to make, sell, and use his invention, will be construed to give the inventor adequate protection where it is possible to do so.

In the present article, Mr. Parker brings out a number of points relating to patents that are not so well known as they should be. For example, the law relating to the removing of a part or the adding of a part to a mechanism, and the effect that this has on infringement procedure, is not generally understood. Another question that he answers relates to the validity of patents, where the subject of the patent is so simple that many persons would believe that no valid patent could be sustained. The methods used by the Courts in arriving at the amount of compensation to which the owner of a patent is legally entitled in case of infringement of his patent is another point brought out in this article.

Numerous litigations have resulted simply because few people realize that a person who makes a patented invention, although for his own use, is liable as an infringer. A person who rebuilds a patented machine, even though it is legally purchased, may be liable for infringement. However, where a mechanic in the employ of a company replaces a broken part, it has been held that such minor repairs could not be held an infringement of the patent, because any purchaser of a patented machine has an implied permission to replace minor parts; infringement can exist only when a patented machine is practically rebuilt without permission of the owner of the patent.

Unusual Cases of Infringements

Another source of litigation is where a machine is so constructed that, although it is not an infringement when purchased, it becomes an infringing product after it has remained in use for a sufficient time to permit the parts to wear into a peculiar shape. In a recent litigation where this point of the law was involved, the Court said that where a person rightfully uses a machine and the parts become worn so as to bring the machine within the terms or claims of a patent, the user is not liable as an infringer.

On the other hand, it has been held that where a machine is constructed in such a manner that slight wear will cause one or more of the parts to function differently, so as to infringe a patent, all persons who are in the conspiracy are liable for the damages and profits made.

Weak Claims Prevent Adequate Protection

As previously explained, the Courts are in favor of upholding the rights of inventors, but very often the claims of a patent are so weak, that the patent is of little value, and, therefore, it is an easy matter for a manufacturer to make, sell, or use a device that is quite similar, but does not infringe the terms of the claims of the patent in question. For example, where a patented improvement of a machine was shown and described as comprising several important parts, the Court held that the maker and user of a similar improvement, having one less part, was not an infringer. That is important information, and this decision has been upheld by numerous other Courts.

In another case, where a similar point of the law was involved, the Court said that any person is privileged to make a patented invention with fewer parts than are specified and claimed by the patentee. The Court explained further that the patent laws are primarily intended to induce inventors to perfect things by which the public might be benefited, and that any person who can reduce the number of parts in a machine, or reduce the steps or operations in a process, is entitled to be considered by the Courts as an inventor, because it is very important to lower the manufacturing cost of a product, and a reduction of the number of parts of an efficient machine is one certain way of accomplishing this purpose.

Improving a Mechanism by Adding Parts

However, while any person may avoid infringing a patent by the omission of a part, it is important to know that adding to a patented invention does not accomplish the same effect. For illustration, in a recent litigation, the Court held that the addition of some part to those shown by a patent does not avoid infringement, if the substance of the invention is taken by the would-be improver, or the principle or mode of operation is retained. In

other words, where a patented machine is simply improved by adding one or more parts, although the improver may obtain a patent on his invention, he cannot use it, unless he obtains permission from the owner of the original patent.

Occasionally, in view of the established law that the omission of a part of a patented machine avoids infringement, various persons and firms have attempted to avoid infringement by simply combining two parts into one; but the attitude of the Courts relative to this phase of the law is clearly indicated by the outcome of a recent litigation in which it was held that infringement of a patent is not avoided by making into one piece that which was shown and claimed by an inventor in two pieces, especially where no advantageous results are effected; and where a company built and sold a machine having a sleeve constructed in a single piece instead of being split, as claimed in the patent, the Court held the builder liable as an infringer.

Validity of Patents on Simple Appliances

There has been considerable litigation where the subject of a patent is so simple that many persons believe no valid patent can be sustained on such a small and apparently unimportant invention. However, a Court recently said that simplicity of a device is no evidence of the want of invention, as in such cases the validity of the patent must be determined by the results accomplished. The exact words were: "The simplicity and obvious nature of the device seem to be the chief argument against its patentability, but the books are full of cases where patents have been sustained for changes in methods which seem equally simple." Another Court said: "To obtain absolute simplicity is the highest trait of genius."

Compensation Obtainable in Infringement Cases

Sometimes, however, the simplicity of an infringed invention may have considerable bearing upon the amount of the judgment awarded a patentee. Since few persons know of the methods of the Courts in arriving at the amount of money to which the owner of a patent is legally entitled, perhaps a few illustrations may be informative.

It is well established that the owner of a patent may recover a judgment for the damages he has sustained by the infringement, as well as the profits made by the infringer; but it is important to know that it is a well settled rule of the law that where only a part or portion of a machine is infringed, the patentee must show how much of the profits earned on the complete machine actually are derived from the patented part; and the infringer is bound to prove to the satisfaction of the Court that the sales of the complete machines were not affected and aided by attaching or including the patented part. This is where the simplicity of an invention may affect the outcome of a patent litigation. If the patented part is of little consequence, an inventor may be awarded only a small per cent of the selling price of a machine that actually retails for thousands of dollars.

But whether the infringement concerns a complete machine or only a part, if it can be proved that the infringement was knowingly and purposely done, the infringer may be liable for increased damages or "smart money." The Court is privileged to render a verdict of three times the actual or general damages and profits, if it so desires; but this additional amount is awarded only where the infringer is thoroughly aware that he is infringing. Where the validity of a patent is a debatable question, and is contested by the person who is accused of infringing, no increased or "smart money" damages are allowed.

Penalty for Marking Unpatented Articles "Patented"

The laws of patents are formulated to prevent persons from violating the regulations; and the penalties for violations of the laws usually are severe. While it is a well-known law that the manufacturer of a patented machine shall stamp on it "Patented," with the serial number of the patent, or the date on which the patent was allowed, few persons know that the law specifies also that any person who marks an unpatented device with the mark "patented" or other similar mark is liable to a fine of $100 for each article so marked. Further, one-half of the fine shall be paid to the person who files the suit. In other words, any person who knows that a person or firm is fraudulently marking an unpatented article or machine "patented" may sue the guilty one for $50 for each article thus manufactured.

While the law that relates to falsely marking an unpatented invention with the word "patented," or similar word, is actually in effect and unknown to a vast majority of persons, it is also true that almost all inventors and manufacturers freely use the term "Patent Applied For" or "Patent Pending," believing an existing law supports its utilization; but as a matter of fact, there is no law in effect that authorizes its use. It is merely a term adopted by inventors themselves. There are many records of legal controversies, however, where persons who have used it to deceive the public have been prosecuted. An improper use of the phrase is looked upon by the Courts as a perpetrated fraud upon the public.

Either of the notices "Patent Applied For" or "Patent Pending" may be imprinted upon an invention for the purpose of truthfully informing all persons and firms that some inventor has begun but not completed, the procedure of obtaining a patent. But it is important to realize that no damages can be obtained by the inventor from a person who manufactures and sells the invention prior to the time the patent issues, even though the inventor takes the precaution to stamp his product with the words "Patent Applied For."

On the other hand, it is not necessary for the owner of a patent to notify an infringer to discontinue infringement before filing suit, if the patent actually is allowed. It is sufficient if the patentee marks the manufactured articles "Patented" with the day and year the patent was granted; if the inventions that are marketed are not properly marked, no damages may be had for infringement until the infringer has received notice from the patentee to discontinue the infringement and fails to do so. For this reason, it is important to properly mark all manufactured patented articles.

Oil-Burning Annealing Furnaces

By C. C. HERMANN

THE use of oil as the heating medium in annealing furnaces employed in the malleable iron industry is a recent development. It has been found so satisfactory, however, that its use in this field is rapidly increasing. In the production of malleable iron, the annealing is of great importance. The malleable mixture may be all that could be wished for, and the castings may come from the molds in excellent shape, but unless the annealing ovens are in good working order and the temperature is kept uniform, the results will not be satisfactory.

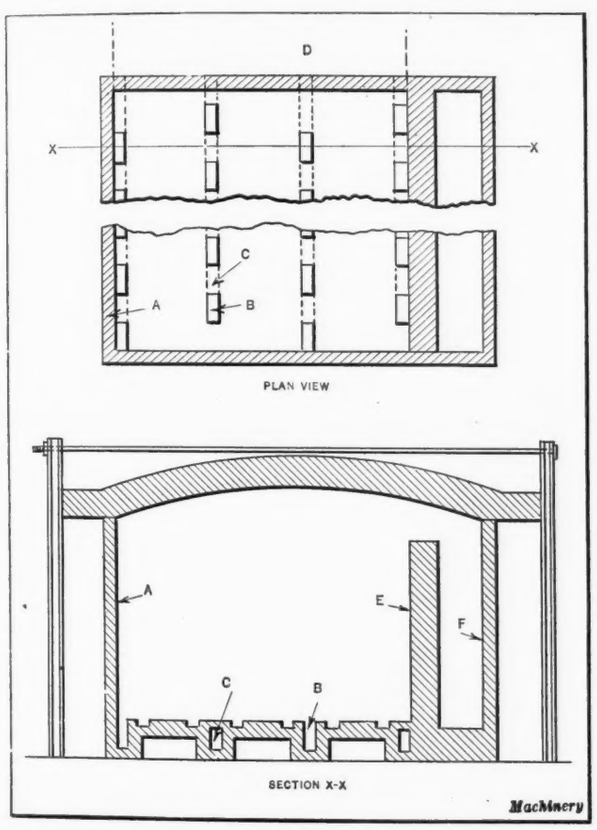


Fig. 1. Plan and Sectional Views of Annealing Furnace

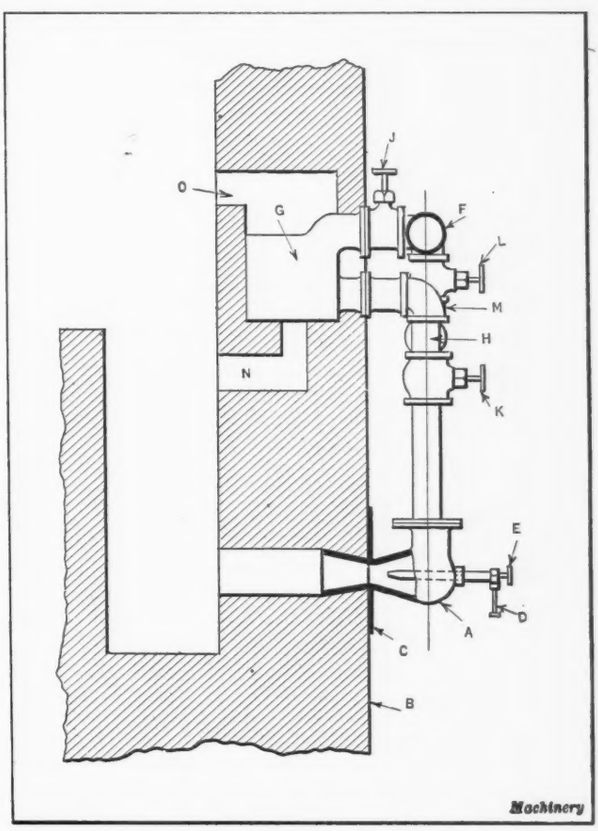


Fig. 2. Burner and Air Preheater Used on Furnace

Before considering the furnace and oil-burner arrangement, it should be understood, that in the annealing process, fundamental changes take place in the steel. The annealing is a necessary step in the production of malleable iron. The castings, on entering the ovens, are extremely hard, but are so changed in the annealing that they are almost like steel. The resulting metal is malleable; that is, the castings can be bent to various shapes without breaking or cracking. Such castings can be case-hardened and, to a certain degree, can be treated the same as steel.

In Fig. 1 is shown a typical annealing oven. The interior lining *A* is constructed of firebrick backed by common brick, the total wall thickness being about 18 inches. The floor is provided with a number of openings *B*, which lead to ducts *C* through which the gases of combustion and the waste gases pass on their way to the stack flue *D*. The wall *E* forms a baffle surface for the oil burners, which are located in the outer wall *F*. The side elevation of the furnace, Fig. 3, shows some of the oil-piping and the location of the burners. The uprights *G* are staves which are intended to reinforce the walls *H*. The oil-burner opening is indicated at *I*, and the air preheater, in case one is used, by the dotted lines *J*. The air-piping is shown at *K*, and the oil-piping at *L*.

Details of Oil-burner

A sectional detail view of the oil-burner, including the air preheater, is shown in Fig. 2. The burner *A* is mounted in the wall *B* by any suitable means, such as the flange *C*. The oil supply pipe *D* is provided with a needle valve *E*. The air supply pipe shown at *F* connects with the heater *G* placed in the wall of the furnace. The heated air passes out of the pipe *H* to the burner *A*. A gate valve *J*, placed ahead of the heater, and another one at *K* on the burner side, permit the heater to be removed without shutting down the burner. When valve *L* in by-pass *M* is open, cold air can pass to the burner.

Heat from the furnace is by-passed around the heater *G* by means of the ducts *N* and *O*. In later

designs, this air preheater is placed in the stack, where it absorbs the necessary heat from the flue gases. The floor area of the oven shown in Fig. 1 is 120 square feet, the dimensions being 8 feet wide by 15 feet long. The mean height of the oven chamber is 5 feet 9 inches. The total volume of the brickwork is 600 cubic feet, and its weight approximately 66,000 pounds.

When loaded, the furnace contains 10,995 pounds of castings, annealing pots weighing 36,000 pounds, and approximately a ton of scale. The initial temperature of the oven is 70 degrees F., and the final temperature 1550 degrees F. The total heat required per hour is equivalent to 1,130,000 British thermal units, requiring 7 1/2 gallons of oil per hour, and 20,340 cubic feet of free air. The air is supplied at a pressure of approximately 1 pound per square inch.

Packing Castings in Annealing Pots

As previously mentioned, the castings come to the annealing room in the hard state, with the sprue and gates trimmed off and with the sand and scale from the molding process removed. The first important step in the annealing process is the packing of the castings in the annealing pots. The castings are not allowed to touch each other or the sides of the annealing pot. They are separated by metal scale, which is packed between them.

The pots consist of a bottom and a series of rings, placed one on the other, thus building the pot up to the maximum practical height. The pots of castings are placed in the oven, and arranged in even rows lengthwise and across the oven. Light castings are never mixed with heavy castings. The packing is kept as nearly uniform as possible.

Parts containing light castings are placed in the portion of the oven where the temperature is likely to be the lowest, and the pots of heavy castings are placed in the hottest portion of the oven. This is mentioned because in practically every oven there will be a zone of maximum temperature, in spite of the fact that every effort is made to keep the temperature uniform throughout.

The Annealing Operation

When the oven is filled with the loaded pots, the entrance is bricked up and the fire started. The temperature is increased gradually, pyrometers being inserted in the oven so that the exact temperature is known at all times. The time to bring the heat up to the required temperature of 1450 degrees F. is seventy-two hours. The temperature is then kept at this point, as nearly as possible, for another seventy-two hours. For furnace malleable iron, this temperature must not be exceeded; and it is best to keep it slightly below this point, but never below 1250 degrees F.

For cupola malleable iron, the temperature is generally from 150 to 250 degrees higher, that is, from 1600 to 1700 degrees F. After the required seventy-two hours at the given temperature, the heat is gradually dropped, approximately 12 degrees F. per hour, until a temperature of 1250 degrees is reached, at which time the cooling rate can be gradually increased until a temperature below 900 degrees F. is reached. It is then customary to remove the front wall of the furnace and allow the pots to cool rapidly but without scaling. Quite often the pots are removed and dumped while the temperature is still 400 or 500 degrees F.

In order to meet the exacting requirements of the annealing process, it is obvious that the oil-burning equipment must be correctly installed. One of the principal faults observed in a defective installation is the localization of heat at some point, so that proper distribution is not obtained.

It may be well to state here that tests with furnaces of recent design, produced in accordance with results obtained after much research both in the laboratory and the shop, indicate that the time of annealing can be materially reduced, and also that the packing method practiced in malleable iron production can be greatly improved upon.

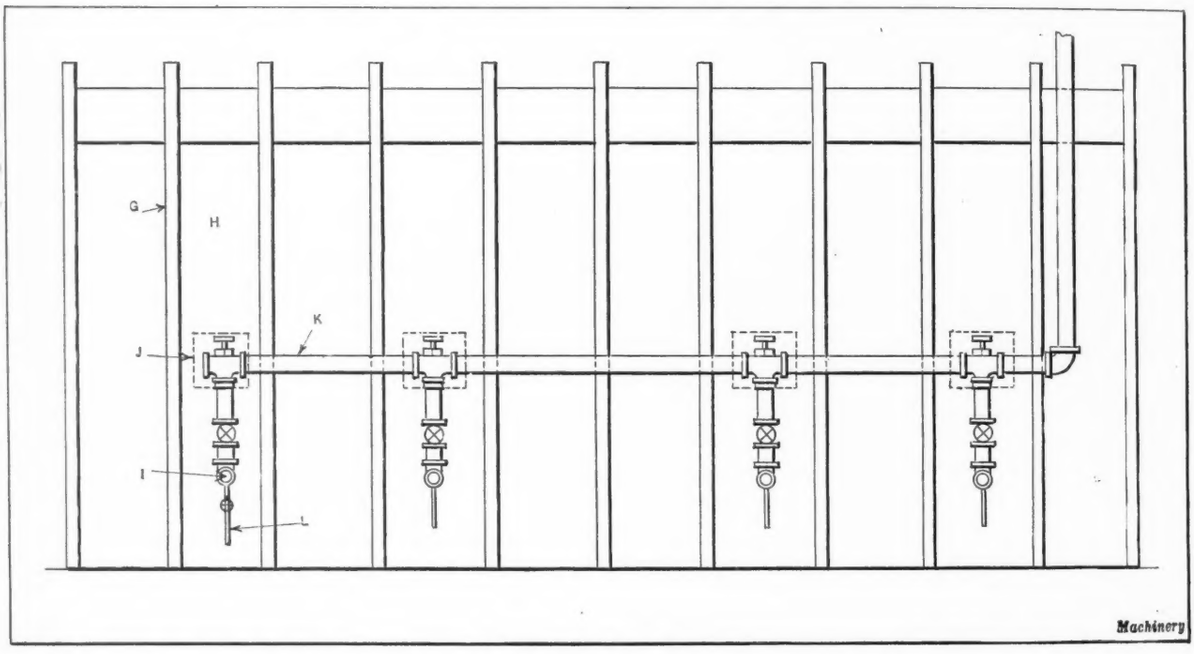


Fig. 3. Side Elevation of Annealing Furnace, the Plan View of which is Shown in Fig. 1

The Future of the Automobile Industry

By EDWARD S. JORDAN, President, Jordan Motor Car Co., Cleveland, Ohio

NOW that the National Automobile Shows are close at hand, it is safe to say that the annual funeral procession of the automobile industry will soon be over. After twenty years of contact with this business, I have always been impressed by the fact that the general public, both in the machine-building and in other fields, is inclined to think superficially about the automobile industry and indulge in forebodings regarding its future at certain periods each year. In every other year two funerals have taken place, one between the fifth of July and the day following Labor Day, and one between the fifteenth of November and the opening of the New York Automobile Show. The year 1926 was unusual in most lines of business in that the expected summer slump did not materialize to the same degree as in past years, and this was true of the automobile industry as well.

The peak of the automobile production was reached in August. Many new models were brought out at that time, and high pressure was brought to bear on the dealers and the public to obtain distribution for these new models. Since the capacity of most of our industries is at least 25 per cent above normal consumption, it is inevitable, in any field as large as the automobile industry, that there should be a period of a few months during which a readjustment of output takes place. This is the readjustment of the factory capacity to the capacity of the dealer to finance and handle second-hand trade.

Edward S. Jordan

It is apparent now that the automobile industry is still in its early stages, with nearly 20,000,000 motor cars in this country and only about 5,000,000 in all the rest of the world. The most significant fact in the automobile business in the past year was that about 400,000 automobiles were shipped abroad. This is significant not only because it means greater prosperity for the industry and a larger volume of export sales, but because it also aids in breaking down the barriers of language, religion, prejudice, and trade rivalry that have kept the nations of the world apart.

The European Type of Car

We have heard a great deal during the past year about the adoption of the European type of car. Those who are not posted on the European situation may be interested to know that there is no such thing as a European type of car. To make this clear, it is only necessary to point to the fact that automobile production in Europe has never been standardized. Certainly, a type implies a standard type. In Europe, each manufacturer has built a car according to his own ideas, and in most cases, each new model has been quite different from that which preceded it. The Society of Automobile Engineers many years ago established a set of standards for the production of automobile parts, which has brought about what we call the American type of motor car. Through standardization and the introduction of the most modern production methods, we have established an American type, but there is no such thing yet as a European type.

American manufacturers, because of traffic conditions and the demand for lower-priced cars, have been inclining toward the prduction of automobiles that will take their place more easily at the curb, and be handled more conveniently in traffic, but this is not imitation of European design; it is simply the result of the demand in this country for smaller, more convenient cars. So, there need not be much fear yet of competition with foreign cars. From the standpoint of service under all conditions, not only in this country but abroad, no foreign car has yet been produced that compares with the average American car. Therefore, when you consider the possibility of our continuing to be the work-shop of the world in the business of automobile transportation, we may reasonably say that the automobile industry is just beginning. So much for the possibilities of the market abroad.

The "New Model" Problem

Unfortunately, the automobile industry is still in a position where the manufacturer is a little too much inclined to take advantage of the enthusiasm of the dealer and the public through the introduction of new models. This has resulted in a multiplicity of models, detracting from the economies of factory operation and multiplying the difficulties of merchandising. From the standpoint of engineering, the industry has been fairly well standardized, and so have the production departments, except for the multiplicity of models which reduce the possibilities of production economies.

Engineering and production having been quite well taken care of, we are now at a point where greater attention must be given to merchandising economies. The dealers' problem is becoming more and more acute through the necessity of handling the majority of sales on a time basis and going through several merchandising operations in order to dispose of the last car taken in trade.

The Future of the "Small Manufacturer"

One phase of the business that is not generally appreciated today is the relation of the so-called

"small manufacturer" to the large-volume producers. In the oil industry we have witnessed the successful development of many companies side by side with the largest corporation in that field.

In the steel industry, we have witnessed the growth of the United States Steel Corporation to a position of power and influence, but we have also seen smaller steel companies operating successfully in competition with the larger company. The history of every great industry shows that the public is better served, even though the larger corporations merely permit the smaller companies to exist.

Of course, in the automobile industry it would not be possible for a single company to dominate the business, because it is not possible to corner brains, style, and hard work.

Where Will the Future Demand Come From?

The developments of the next decade in the automobile business will reveal some interesting things. Twenty years ago, a volume of business that today would be thought insignificant was considered big. Ten years ago, developments proved that the market of the previous decade was far below the possibilities. Today, with every American family arguing at the breakfast table about who is going to use the one car of the family, it is pretty certain that there will be more than one car, and possibly three or four, in every family able to provide individual transportation for its members. Thus, there is a possibility of a large increase in domestic sales, with the whole foreign market also open.

While the trend of American conversation indicates that the chief problems before the country are those of prohibition and the morals of the rising generation, I maintain that the chief problem of the American people is to find a place to park the car. The saturation point can never be reached in the business of transportation as long as people will not walk and cars will wear out; but the saturation point has practically been reached in the floor area provided for transportation.

Those cities whose administrators are sufficiently far-sighted to visualize the future, are making provision for wider streets, more high-level bridges, and broad radiating highways, to reduce the cost per ton-mile in moving passengers and freight.

The Bus and Truck Business

No man living today can foresee the possibilities in the development of bus and truck transportation. That business is in such an early stage at present that no one yet has reached a wholly standardized product. This will come very rapidly as busses replace the slow moving street car, which I have always considered was nothing more nor less than an incubator for automobile prospects.

It was very interesting to observe at the Cleveland Transportation Show the broad vision exhibited by the street railway men in adopting the most advanced ideas on bus construction and transportation. These developments, with capable backing, will be one of the marvels of the next decade.

What Good Transportation Means

During the last ten years, and really since 1921, more surfaced highways have been built in the United States than during the century previous. This means more to the agricultural population than to any other group. The workingmen in the city have been able to make much higher wages than the workingmen on the farm. The successful farmers of the country, with the development of good roads, will be able to sell their products at a price that will make their earning power compare favorably with that of the city man.

The business prosperity of the United States during the last twenty-five years has undoubtedly been brought about largely by improvement in transportation and reduction in the cost per ton-mile, and that development is due to the passenger car and the truck. This point can be made very clear if we think in terms of the individual. Twenty-five years ago the market of the workingman for the sale of his labor was limited by the length of his legs, or his capacity to walk. His radius was widened, by the extension of street car facilities, to possibly ten miles. Now he can sell his labor over a much wider area. That is the principal factor that places the American laboring man in a position to choose an employer; and when a man can choose his employer, his wages and the standard of living immediately rise.

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GASOLINE SWITCHING LOCOMOTIVES

To show the feasibility and economy of gasoline switching locomotives built for standard-gage track, in industrial plants where freight in carload lots is shipped and received, the Mid-West Locomotive Works, Cincinnati, Ohio, recently made a public demonstration of one of their 8-ton gasoline locomotives. A great many concerns handling carload freight, states this company, do not realize that for a comparatively small investment they can obtain a locomotive that will do most of their switching. A large railroad locomotive is not necessary for this purpose. According to information received from this company, there are many cases when a small amount of switching could be done at the cost of from $1.50 to $3 per day, covering fuel, labor, and interest on investment. This represents a material saving over the switching costs when regular railroad locomotives are employed. Attention is also called to the advantages of gasoline power for switching purposes inside of plants, because of the freedom from smoke and fire hazards. The railroads, it is stated, do not object to private switching, because it is generally an expensive and losing service to them. This type of locomotive is now being built in sizes of from 8 to 25 tons.

* * *

If the available technical knowledge that the world now possesses were put to proper use, if all the machinery and equipment now available in the industries were operated to its capacity, and if all available labor were made use of for productive purposes, there is no doubt that the standard of living in the United States, although already very high as compared with other countries or previous periods in history, could in twenty-five years be raised to a level that, figuratively speaking, would be two or three times as high as the present level.

Machining Hupp Automobile Flywheels

Tooling Equipment Used for Roughing and Finishing Semi-steel Flywheels

THE flywheels of Hupp automobiles are finished all over from the rough in four operations. These operations are performed on "Simplimatics" built by the Gisholt Machine Co., Madison, Wis., which are equipped with the tooling shown in the accompanying illustrations. The flywheels are semi-steel castings, and are finished to the dimensions given in Fig. 1. In the following description of the operations, the capital letters refer to the various surfaces of the part, as indicated in Fig. 1, while the small letters refer to the different tools in the tooling lay-outs shown in the remaining illustrations. The heavy solid lines in the tooling lay-outs indicate the surfaces of the work on which cuts are taken in each respective operation.

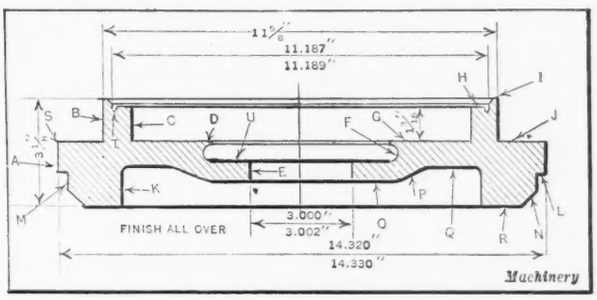


Fig. 1. Sectional Drawing of the Hupp Flywheel

The Roughing Operations

Ten tools are employed simultaneously in the first roughing operation, the tooling lay-out for which is illustrated in Fig. 2. As the rear toolslide advances longitudinally in this operation, surfaces *A*, *B*, and *C* are turned by tools *a*, *b*, and *c*, respectively; opening *D* is rough-bored by tool *d;* and hole *E* is bored by tool *e*. While the tools in the rear slide are being advanced to the work, the front slide is also fed longitudinally to bring the various tools on this slide in line with the surfaces to be machined. Then this slide is fed toward the front of the machine; during this movement, groove *F* is cut by tool *f*, and surfaces *G*, *H*, and *I* are faced by tools *g*, *h*, and *i*, respectively. While these cuts are being taken, tool *j* is fed toward the center of the machine to face surface *J*. The chuck jaws are expanded radially against surface *K* to hold the flywheel securely while this operation is being performed.

In the second roughing operation, the chuck jaws are gripped on periphery *A* of the flywheel, as shown in Fig. 3. When the rear slide is fed longitudinally in this operation, surfaces *L* and *M* are faced and turned, respectively, by the two ground faces of tool *l;* bevel *N* is turned by tool *n;* and surface *K* is bored by tool *k*. The front slide is first

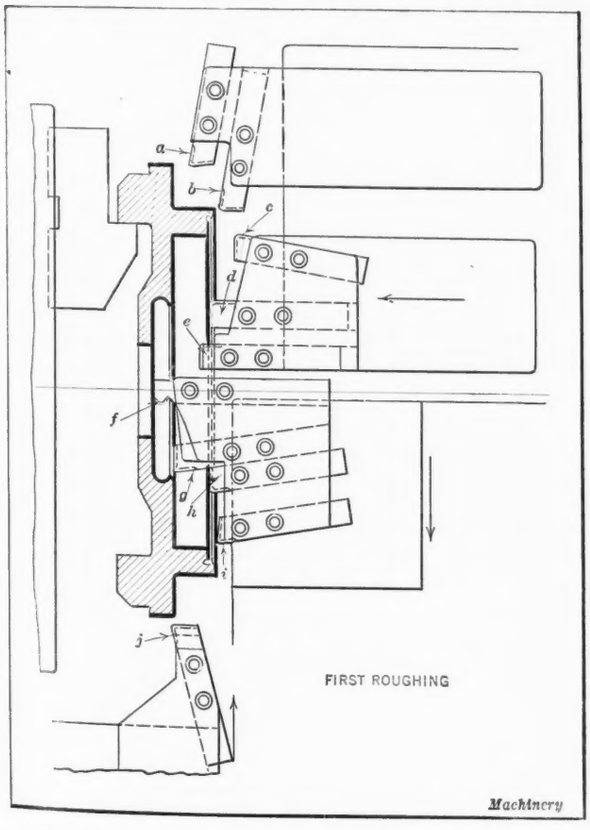


Fig. 2. Tooling Equipment Employed in the First Roughing Operation

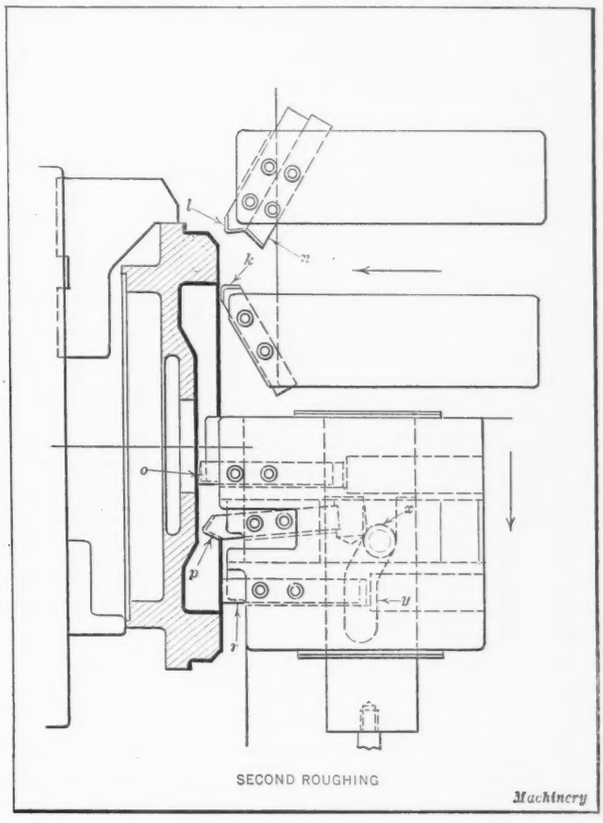


Fig. 3. Arrangement of the Tooling Used in the Second Roughing Operation

fed longitudinally toward the left to bring the various tools in line with the surfaces to be faced, and is then fed toward the front of the machine to feed the tools across their respective surfaces.

One of the features of this operation is the means provided for finishing surfaces *P* and *Q* with the single tool *p*. This is accomplished by mounting the tool in a block that is free to move longitudinally in a slot in the front slide. Fastened to the tool-block is a roller *x* which travels in a cam slot *y* in a stationary cam-plate over which the tool-block moves. Roller *x*, in following slot *y*, feeds tool *p* to the left to follow the contour of surfaces *P* and *Q*. At the same time, surface *O* is faced by tool *o*, and surface *R* by tool *r*.

The Two Finishing Operations

The tooling equipment provided for the first finishing operation is illustrated diagrammatically in

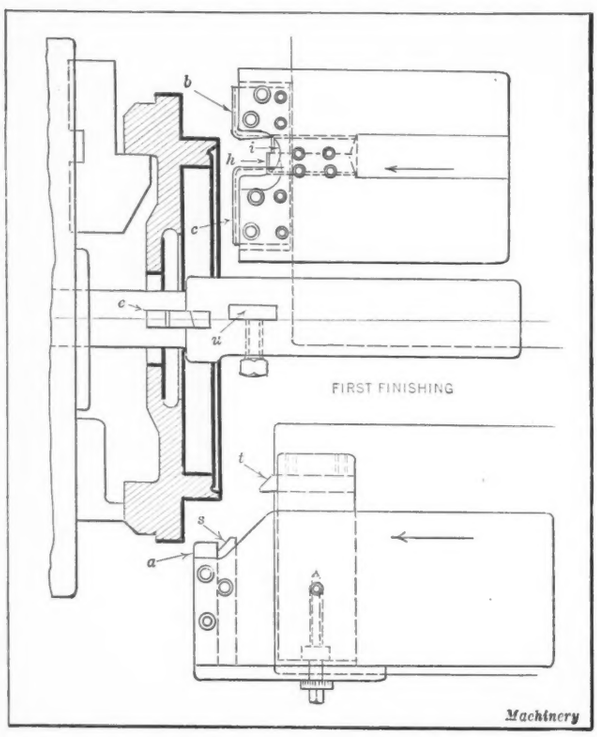


Fig. 4. Diagrammatic Illustration of the Tooling Provided for the First Finishing Operation

Fig. 4, from which it may be seen that the chuck jaws again grip the flywheel on surface *K*. As the rear slide is fed longitudinally, surface *B* is turned and surface *J* faced by means of a wide-faced tool *b;* surface *I* is faced by tool *i;* surface *H* is faced by tool *h;* and surface *C* is turned and surface *G* faced by the wide-faced tool *c*. With the same movement of the rear slide, hole *E* is finish-bored by tool *e*, and surface *U* is faced by tool *u*. In this operation, the front slide also moves longitudinally for finish-turning surface *A* with tool *a;* slightly beveling corner *S* with tool *s;* and sizing counterbore *T* with tool *t*. Both sizing operations are performed with the rear slide slightly withdrawn to eliminate interference from the tools on this slide.

Wide-faced tools are also employed in the second finishing operation, as shown in Fig. 5. When the rear tool-slide is fed longitudinally forward, surface *M* is turned and surface *L* faced by tool *m;* surface *R* is faced by tool *r;* surfaces *K*, *P*, and *Q* are finished by tool *k;* and surface *O* is faced by tool *o*. This slide is equipped with a pilot that enters a bushing in the chuck of the machine to steady the tools during the cuts.

The operations described are performed in four "Simplimatics" tended by two operators. Ninety-one finished flywheels are averaged per eight-hour day with these machines and two men, or one flywheel every 5.27 minutes.

* * *

CENTRIFUGALLY CAST BRONZE GEARS

A paper was recently read before the Institute of Metals at Liege, Belgium, on bronze worm-gear blanks produced by centrifugal casting. This method of producing worm-gear blanks has been stimulated by the growth of the automobile industry, and the paper referred to, which is reprinted

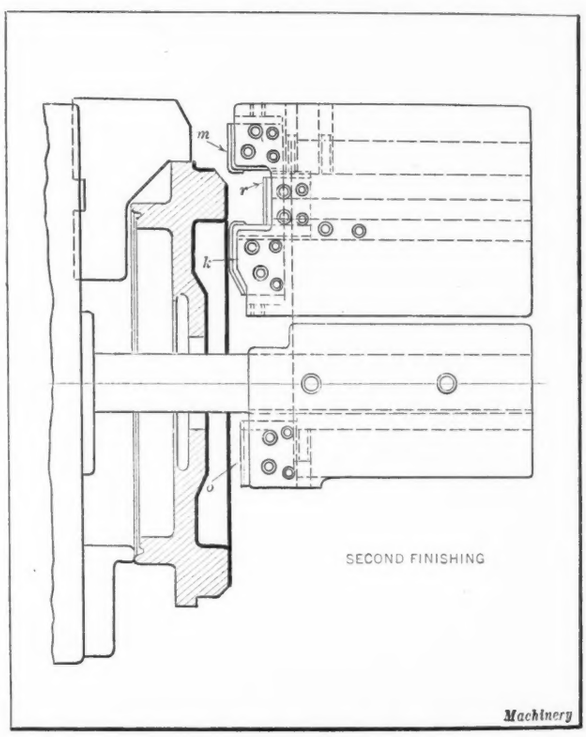


Fig. 5. Lay-out of the Tooling Equipment Used in the Second Finishing Operation

in *Engineering* (London) of September 10, contains matter of considerable interest to those who specialize in this particular branch of the industry. In addition to describing the centrifugal process, the author describes how, up to the development of this method, the worm-wheel blanks used by the firm with which he is connected had for many years been cast with a cast-iron chill embodied in the mold to chill the periphery of the gear. However, this produced a blank having different physical properties on the outside and inside. The molds for the centrifugal casting are made of steel, but by the use of the centrifugal process, physical properties are obtained that are an improvement, in general, on those of an ordinary die-casting. This difference is especially revealed by microscopic examination, even though the density and hardness shown by ordinary tests on a centrifugally cast part do not appear to be a great deal higher than in a die-cast part.

Installation of Power Transmitting Shafts

By J. H. RODGERS

IN obtaining a satisfactory solution to the problem of production, the factor of power transmission is of prime importance. The efficiency of a plant is based largely on the percentage of energy delivered to the respective machines, compared to the developed or available power at the primary source.

Frequently, output is restricted owing to failure of some part of the power installation, or to neglect in correcting a fault after it has become evident. Too much attention cannot be given to this essential feature of plant operation. The treatment accorded to shafting, pulleys, and belting should be considered one of the fundamental details upon which the efficiency of the shop is based.

No plant can expect to maintain a high rate of production unless the transmission equipment is constantly kept in the best condition. To accomplish this, it is advisable—and in large factories almost essential—to place the maintenance of this branch of the work under the supervision of an experienced mechanic (with assistants, if necessary) who can give his entire time to these duties. When every machine operator is permitted to repair his own belts, and tighten or adjust pulleys, effective operation is an uncertain factor.

While it may be true that some men are thoroughly familiar with the peculiar and often apparently insignificant features relative to belt repair and upkeep, it is nevertheless good practice to have the transmission maintenance in charge of a man or gang especially selected for the purpose. We say selected, in preference to appointed, as it is particularly desirable that the men chosen for the work of installation or repair, should know the "why" as well as the "how" of doing it. The varied conditions under which a belt man has to perform his duties provide experience which enables him to evolve ways and means to secure the maximum efficiency from the machinery and equipment under his charge.

The information given in this article is the result of observation and long experience in the use of transmission equipment, and is set forth as an aid to those who have to do with the installation and subsequent repair and maintenance of power accessories.

Lineshafts for Group Drives

In the unit system of machine operation, where each tool is driven by its own individual motor, the installation of overhead shafting is seldom required, but where the group system is adopted, it necessitates having a line of shafting to distribute the power to the different machines located about the shop. In modern practice, the group drive is so arranged that the use of long lengths of shafting is often eliminated, and where main shafts of excessive length are used, it is considered an economic feature to arrange the power distribution in such a way as to minimize the torque throughout the shaft.

This twisting action may often be so great as to develop a grave source of annoyance, and eventually necessitate the rearrangement of the drive to overcome the trouble. Frequently, an installation

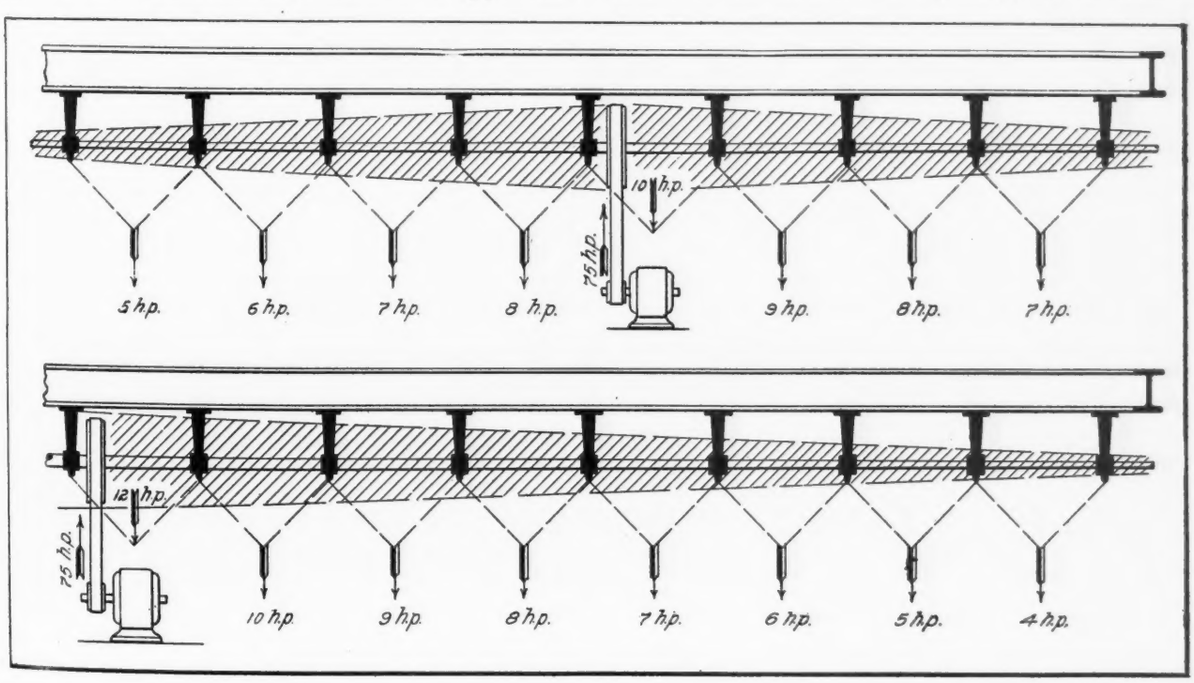


Fig. 1. Diagrams Illustrating Theoretically Correct Power Transmitting Shaft Installations

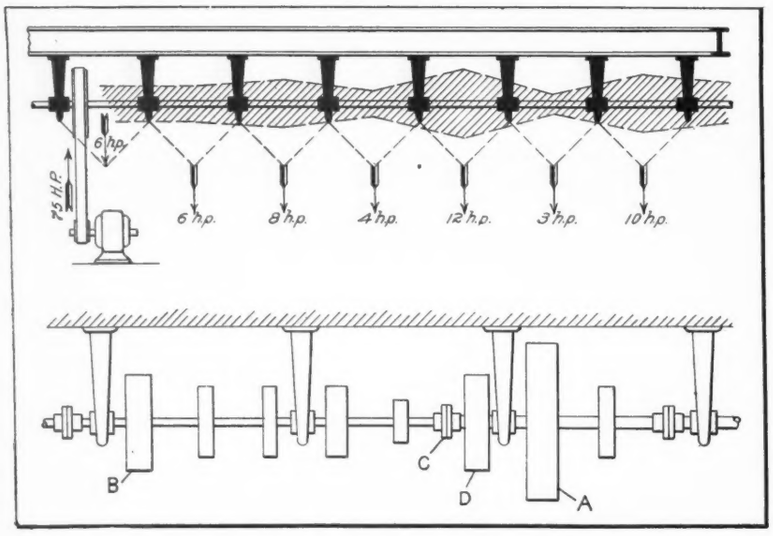


Fig. 2. Examples of Incorrect Installations

of machinery may be made in a plant, or additional units located in available space, with but little thought of the source or distribution of the power that is required to operate the different machine tools.

Reducing the Twisting Moment

In determining the position of the machines in a group, or in adding a tool to existing equipment, the volume of power required to operate, and the special purpose of the machines, are two factors that should be given careful consideration. The heavier machines, which require a proportionately high percentage of power for their operation, should be located as near the source of lineshaft power as conditions will permit. This is particularly important when the load is variable or changes rapidly from full to no load.

While no fixed rule can be applied for installations of this kind, owing to the fact that no two plants are identical in their lay-out or production requirements, a general recognition of stabilized distribution would meet the end desired in practically every instance. It is seldom that the entire power developed by the engine or motor is consumed in operating the equipment, so that in initial installations, allowance is always made for subsequent additions to be operated from the primary lineshaft.

The character of the motor support is very important, but depends upon local conditions. Good results are obtained by locating the motor on the ceiling or on a specially constructed concrete base. The former practice provides more available floor space, but the latter assures a more stable foundation and is more accessible for repairs. When a support of this kind is not permissible, a substantial timber or fabricated steel framework may be constructed to carry the motor, which may be located on the floor, wall, or ceiling. The fundamental requirement, however, is to have the support rigid enough to minimize vibration—a condition that is invariably the cause of many motor troubles.

Suitable Location of Motor Drive

It is good practice to locate the driving motor about midway of the lineshaft length, as shown in the upper view of Fig. 1. When delivering to or taking power from a shaft, it is advisable to place the pulley as close to the hanger as conditions will permit; this rule applies particularly to heavy drives, or those where the need of power is intermittent, such as in the operation of machines requiring a flywheel for stability, like power presses, punching and shearing machines, and similar equipment. When machinery is being installed in a plant, it is advisable, for effective operation, to locate the heavier tools close to the main drive, so that the torsion in the shaft will be kept at the minimum, the lighter tools being situated farthest from the motor.

The upper view in Fig. 1 will serve as a good illustration of the central drive method; this shows the reducing value of the power delivered when nearing the extreme ends. This, however, is an ideal condition, and can only serve as a guide for an actual installation.

When the drive is located at one end of the shaft, as shown in the lower view of Fig. 1, it is imperative that the heavier machines be placed at the motor end of the shop. The farther such machines are situated from the motor, the greater the twisting moment of the shaft and the greater the possibility of lineshaft trouble. When main lineshafts are extremely long, it is good practice to adopt a reducing size of shaft to aid in overcoming the torque.

An example of a lineshaft drive that should be avoided is shown in the upper view of Fig. 2. Here the drive is on the end, the diameter of the shaft uniform throughout its entire length, and the power delivered very irregular—factors that would provide excellent opportunities for inefficient operation. The shaded portion shows the varied fluctuations in the power delivered, and the possibility of troublesome torque is obvious.

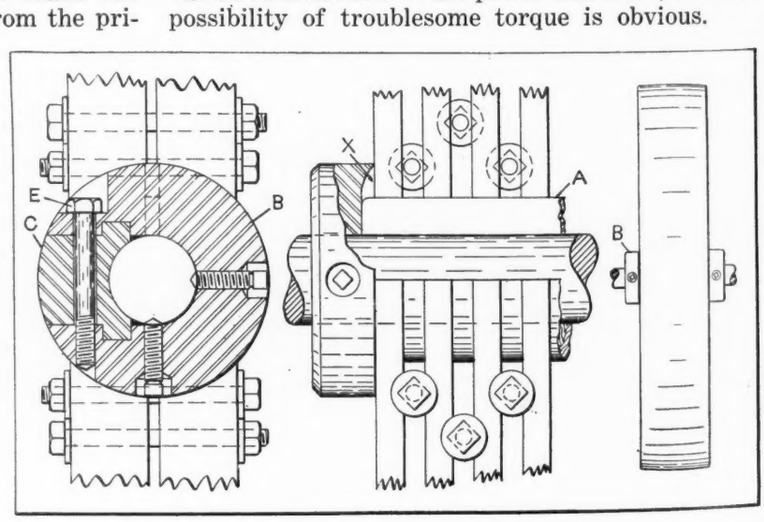


Fig. 3. Method of Securing Split Pulley to Shaft

Specific Case of Inefficient Installation

A particular instance of ineffective lineshaft drive is illustrated diagrammatically in the lower view of Fig. 2. Originally, this shaft was driven by a steam unit belted to the large 6-foot cast-iron pulley *A*, which was keyed to a length of 2 1/2-inch shafting. The advent of the motor placed the engine in the discard, and the new source of power was at the pulley *B*, the size of the entire lineshaft, apart from the portion previously mentioned, being 2 1/16 inches in diameter.

To the left of the driving pulley *B*, was approximately fifty feet of shafting, carrying pulleys for operating various presses and other small tools. To the right, were two punch presses and a small draw press. Adjoining the reducing coupling *C*, and on the larger shaft, was the 4-foot drive pulley *D*, for the heavy drawing press. When the latter was in operation—more especially when on heavy draw work—the coupling *C* was a source of constant annoyance, giving out a continual "squeak" when the full load came upon the press.

The cause of this particular trouble was laid to the fact that the pulley *A* was out of balance, and had a pronounced oscillating motion, due to its poor alignment. Its removal was contemplated on different occasions, but no determined effort was made to remove it. It is the writer's opinion, however, that the primary cause of the shaft trouble was the inefficient arrangement of the drive itself, and the location of the heavy draw press in relation to the motor drive.

In addition to the trouble arising in the coupling *C*, the pulley *D*, which operated the large draw press, could not be kept tight on the shaft, and persisted in slipping slightly when the full load came on the press; this slip invariably was accompanied by an annoying squeak. This pulley was of the wood split type, but persistent tightening of the clamping bolts was of no avail. Sandpaper and emery cloth were tried between the bushings, but only provided temporary relief.

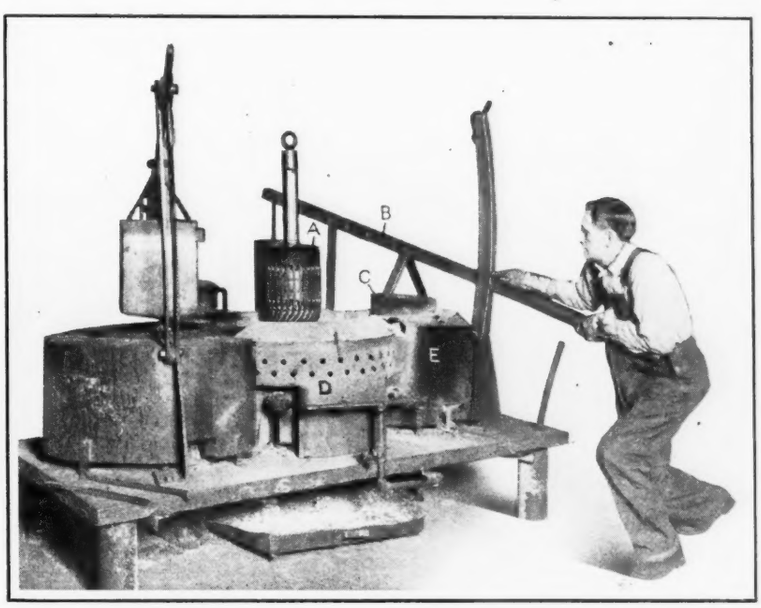
Holes 1/4 inch in diameter were then drilled in the shaft at each side of the pulley, and in line, and a 3/16-inch strip of steel was placed between the two halves of the pulley, this being the available space after the clamping bolts were tightened. On each end of the steel strip was a short projection, about 3/8 inch in length, that entered the small holes in the shaft. The clamp bolts were used as backing to support the steel strip. This arrangement served the purpose for a short time, but eventually the end projections were cut off.

The final and effective repair is shown in Fig. 3. Two collars *B* were provided, open on the side so that they could be placed over the shaft, and the gaps filled with the piece *C* fitted in T-slots, the parts being secured by clamping bolt *E*. The steel strip *A*, located as in the previous case, entered a slot *X* milled in each collar. When in position, the collars were secured to the shaft by two set-screws. The shaft can, of course, be spotted to receive the points of the set-screws so that there will be less danger of slippage. A general view of the completed repair is shown at the right.

* * *

SOLDERING COMMUTATOR NECKS

An operation of unusual interest, performed at the plant of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., consists of soldering the rotor field coil to the commutator of rotor assemblies. This is accomplished with equipment like that here illustrated. A large band of asbestos is first wrapped around the commutator on one side of the coil, to prevent the solder from running over the commutator, after which the entire unit is placed vertically in the equipment, as shown at *A*. The lower end of the unit seats in a plate on which a certain amount of solder is kept heated by means of gas jets beneath the plate.



Equipment Used in Soldering the Coil to the Commutator of Rotor Units

When the unit has been positioned as described, the operator pulls handle *B* down to lower a large cylindrical casting *C*, which is closed at one end, into a tank that holds a large amount of melted solder. This cylinder displaces the solder and forces it into the middle tank within housing *D* and up around the neck of the commutator. At the end of the operation, handle *B* is lifted to permit the solder to flow back into tank *E*. A counterweight at the rear end of handle *B* facilitates the operation. At the left-hand end of the base is an additional tank and mechanism for forcing solder into the middle compartment.

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In recent airplane trials in England, as mentioned in *Engineering* (London), engines were used equipped throughout with ball bearings. It is stated that one of the planes provided with ball bearing engines was the only one to finish in the reliability competition.

The Value of a Repair Parts Booklet

By HAROLD B. SCHOTT

A BOOKLET of repair parts, illustrated by photographs, has considerably more value to the company issuing it than a mere list of the parts. The additional value in the form of advertising—a very important factor—is often not realized and, in many cases, unappreciated. Think for a moment where the booklet goes; in different plants where various systems are employed it may go to several places, yet ultimately it comes to the man in some mechanical department who is responsible for repair parts. A machine tool may be the last word in construction—a machine of accuracy, durability, and large productive capacity, a pleasure to operate and pleasing to the eye—yet to this important man, it means little more than as represented by the booklet of repair parts accompanying it.

It is important to cultivate the good will of the man who is responsible for ordering repair parts, because, in many cases, his opinion with regard to repairs and maintenance of machines is often obtained before a new machine is purchased. His opinion is naturally influenced by recollections of the difficulties or the ease with which he has obtained repair parts from the company whose machine is under consideration. A vision of complicated line drawings, disassociated part numbers, receipts of wrong parts, losses of time, much correspondence, etc., arises in his mind when he thinks of a company whose makeshift repair parts list is uninviting and difficult to understand.

Perhaps, on the contrary, this man visions an attractively covered pamphlet lying on his desk—a pamphlet that contains photographs of every part of the machine. There is a picture of the assembled machine at the front, followed by a series of pages illustrating the principal units of the machine, and on these pages of units, the parts are laid out in the order in which they are assembled, correctly named and numbered. He recollects the ease of identifying the desired part, its distinct name and number and also the dispatch with which he obtained the parts required. When he has had such an experience with a firm, its product stands high in his estimation, and regardless of the machine's actual performance or its durability, there is one man on the purchasing board who is the friend of the firm that builds the machine.

With an attractive cover, the up-to-date booklet of repair parts keeps the name of the company before people, and gives a favorable impression of the concern. Such a booklet builds good will, the same as an expensive catalogue or a piece of direct-by-mail advertising matter. Many manufacturers are aware of the advantages of an attractive booklet of repair parts, and send out booklets of this kind with their machines. On the other hand, a considerable number of manufacturers are of the opinion that the cost is excessive and, consequently, do not make use of them.

Fig. 1. Photographing Parts with Equipment that Reduces Retouching Costs

Reducing the Cost of Retouching Photographs

Sometimes it is argued that the cost of photographing the parts and of retouching the photographs to eliminate shadows and obtain a uniform background, makes the expense of an illustrated booklet assume undue proportions. However, for an ordinary commercial job, retouching costs can be considerably reduced when parts are photographed by the method to be explained. This method is employed by a concern whose assembled products vary in weight from approximately 500 to 10,000 pounds.

Large parts, such as castings, heavy shafts, etc., are placed on white paper, laid on the floor, and photographed from above. When photographs are taken in this way, shadows cannot be eliminated either by daylight or artificial lighting, but as the heavy parts are few in comparison to the total number of parts photographed, the retouching costs, when spread over an entire job, are not objectionable.

The real saving is in photographing the small parts of mechanical units. This is done by means of the equipment shown in Fig. 1. The parts are

laid on a box-like table, which is mounted on a stand. The stand is movable so that it can be conveniently positioned beneath the camera, which is fastened to a platform suspended from the ceiling, as shown. The box has wooden sides and bottom and a heavy plate glass top; it measures about 4 by 5 by 1 1/2 feet. Within the box, there are nine 75-watt violet-ray lights, arranged in three rows. The inside of the box is painted white, and a strip of paper under the glass diffuses the rays from the lights.

The stand is made of heavy timber, and is so designed that the box can be either raised or lowered. This is accomplished through coarse-pitch screws at each end of the stand, which are turned by means of the handwheel shown. Guides are placed at each corner of the frame, as may be clearly seen in Fig. 2, to keep the box steady, and it is locked in position by clamping screws.

The platform is suspended about four feet from the ceiling. As may be seen in Fig. 3, the camera is fastened to a board which can be slid vertically between guides extending from the ceiling to the platform. By sliding the camera board up or down and adjusting the box table vertically, a range of focus sufficient for all purposes is obtained.

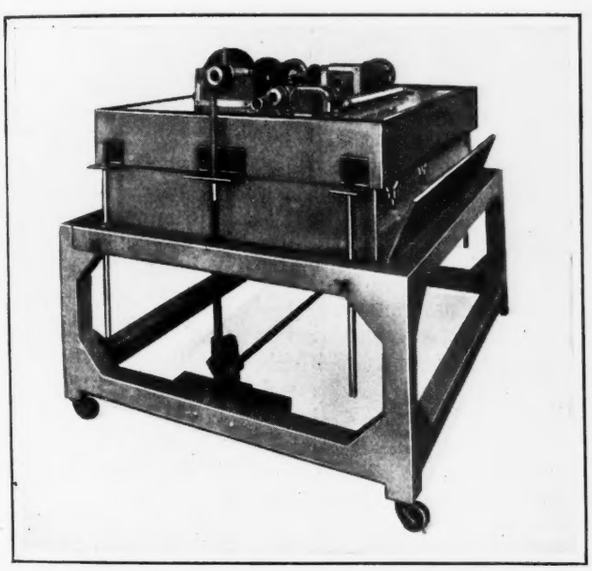


Fig. 2. Table with Glass Top and Lights Inside, by Means of which Photographs can be Taken with a Uniform Background

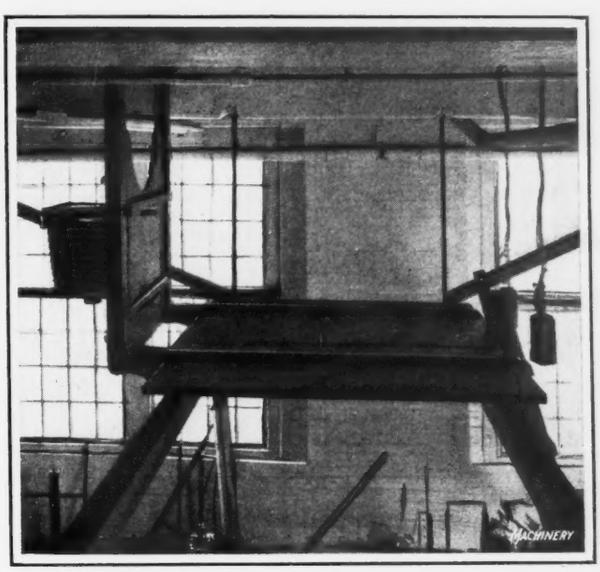


Fig. 3. Platform Located Close to Ceiling, with Camera Mounted on an Adjustable Board to Facilitate Focussing

A little time spent in preparing the parts before photographing is well invested. All brightly painted parts are made dull, because a glossy paint reflects the light to such an extent as to cause halation in the photograph. Sometimes it is worth while to repaint parts with a dull, non-reflecting paint. Highly polished surfaces also reflect too much light, and these may be daubed with putty to dull the finish. Irregular shaped castings, with indentations that do not show up readily, are strengthened by chalking the outside edges.

How the Equipment is Used

All parts of a unit are laid on the glass table top in the relation in which they are assembled. To hold irregular shaped pieces in their proper places, it is customary to prop them up with wood, putty, plastilina (obtainable at practically any artists' supplies store), or some similar material, but care must be taken to arrange the props so that they do not show when looked at through the camera. In the case of round parts, shafts, etc., a little daub of putty will keep them from rolling. The parts are arranged in a rectangle of such proportions that the halftone cut that is made from the photograph will fit into the required space in the repair parts booklet.

At a certain time during the making of an exposure, the lights in the box are switched on, with the result that the negative will have an even density of background and no shadows. The best time for turning on the lights can be determined after a little experimenting. Photographic prints produced from negatives made as described require no retouching other than the strengthening of a part here and there. A typical example is shown by Fig. 4, which is a halftone cut reproduced from a print on which no retouching whatever was done. When the platform and camera are focussed properly an entire set of photographs of various units may be taken without disturbing the setting, and so all parts may be photographed in relative size.

The only work required on prints like that shown in Fig. 4, before they are sent to the engraver, is to number the parts. The best practice is to letter the numbers directly on the prints, even though the halftone screen may make them lighter. It was found undesirable to place numbers under the parts and photograph them together, because any changes that occurred in the numbering could not be readily made on the negative.

The initial cost of the table, stand, and platform may seem somewhat high, on first consideration, but if a number of pictures are to be made, the money saved by not having to retouch the backgrounds soon pays for the cost. Also this equipment may be used for photographing views of machine operations, samples of work, etc.

Laying Out the Booklet

As previously stated, the repair parts booklet is a valuable piece of advertising matter, and there-

fore should present an attractive appearance. It reflects the stability, integrity, and progressiveness of the firm it represents. Give time and study to the lay-out of the booklet, and list the parts and their numbers as close to the illustration as possible. A good practice is to use the left-hand pages of the booklet for illustrating the parts and the opposing right-hand pages for listing the names and numbers of the corresponding parts. Give any special instructions for ordering as clearly as possible; in fact, repeat them on every page, if important. Such a booklet cannot be made too comprehensive, as orders correctly made out by customers for repair parts will save the manufacturer much time and trouble.

A final word—use good paper. The difference in cost between a cheap or fairly good paper and a very good paper is so slight and the results so apparent that one wonders why some manufacturers spoil what would otherwise be a good looking booklet by trying to save a little on the paper. Halftones made with screens of 150 lines per inch are preferable for such work, as they bring out the details of mechanisms and parts to the best advantage, but good paper must be used in printing them. Printers, like other craftsmen, do better work when provided with the best grades of materials.

A good cover stock is also of importance, for the cover is the final touch. Use a good grade of tough stock that will stand up under hard shop usage; thin paper covers do not meet this requirement. A dark shade of stock is preferable, since light colored covers will soon become dirty in the shop.

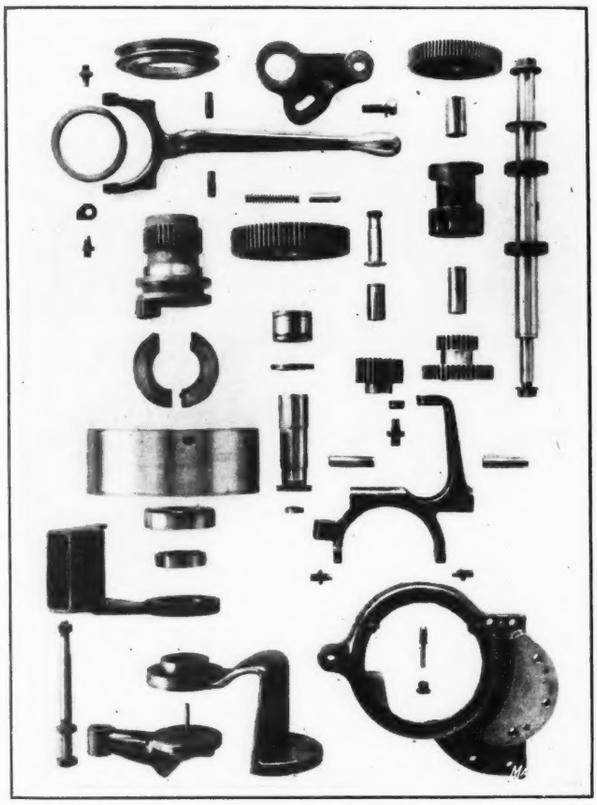


Fig. 4. Typical Photograph Made with the Equipment Shown in the Other Illustrations

* * *

The American Arbitration Association, with headquarters at 342 Madison Ave., New York, has enlisted two thousand business leaders in the ranks of its active workers, representing every branch of industry in the United States. Immediate and inexpensive settlement of trade disputes is assured in every business community in the country through the increased facilities of the association. It is prepared to furnish arbitrators, rules of procedure, and prompt decisions anywhere in America. In the professional field the association is cooperating with such national organizations as the American Society of Civil Engineers, the American Institute of Accountants, the American Society of Public Accounts, American Bankers' Association, and National Association of Credit Men.

AIRPLANE DEVELOPMENTS IN THE UNITED STATES

The first air mail route in the United States was opened May 15, 1918, between Washington and New York. The transcontinental route from New York to San Francisco, 2669 miles "as the airplane flies," was placed in complete operation in 1920, but through daily schedules involving night flying were not begun until July 1, 1924. This line is government-operated. There are also several air routes under private contract. Express matter and passengers are now being carried between Detroit and Grand Rapids, while mail and passengers are being carried from Philadelphia to Washington, and passengers are being transported between Philadelphia and Norfolk, Va. Approximately 14,000,000 letters are carried annually by the government-operated mail planes.

The primary cause of the slow development of commercial aviation in the United States, according to a bulletin of the Guggenheim Fund for the Promotion of Aeronautics, is that the public has not had sufficient faith in the safety of flying. When a greater degree of safety is assured, the public will give air transportation greater support. As an example of how safe flying can be made, the bulletin refers to a German company that last year carried 133,639 passengers and 2,240,000 pounds of mail, freight, and baggage, for a total of over 4,675,000 miles with only two fatalities.

Air transportation demands many things that the layman never thinks of. The airways must be mapped and equipped with emergency landing fields and navigational aids. Since weather conditions play a most important part in flying, the pilot must have accurate meteorological data supplied by radio. For night flying, the airways must be illuminated and the airports must have sufficient lighting apparatus to permit safe landings. Consequently, regular air flying is dependent on installation of this equipment by the government, which is the only agency with sufficient capital to bear the burden of such development.

Of the 2669 miles in the transcontinental route, the 2045 miles between New York and Salt Lake City are lighted by 520 gas or electric lights, some of which are automatic. Installation of the lighted airway cost $542,108, and the annual maintenance costs about $300,000, half of which is in wages for the caretakers.

Cost Estimating in Contract Shops

By JAMES ALLEN THOMAS

AN article appeared in June MACHINERY (page 811) on the subject of using the cost system as a basis for estimating. It might be of interest to demonstrate a system of estimating in which the cost system is made use of. An estimate on some large slide gates made for the Bureau of Reclamation of the United States Government for use in connection with dam construction on a reclamation project in Idaho and Oregon will be taken as an example.

The specification called for two gates, 4 by 4 feet, and three gates, 4 by 5 feet, in the gate opening. The main bodies of the gates were to be of semi-steel, the gate leaves of semi-steel and the stems of bronze, and the seats on the gate bodies and leaves of bronze. The gates were to be operated by hydraulic cylinders lined with bronze, and the pistons and piston-rings were also of bronze. The cylinder bodies were to be of steel castings, and after complete assembling, the cylinders and pistons were to be tested under high hydraulic pressure, using oil as a medium.

Bids Sometimes Show Wide Variation

Bids on this job were received from seven different shops. Since the various amounts bid have been made public, they will be given to illustrate how such bids often vary, due chiefly to lack of reliable cost estimates and data. The seven bids were as follows: Firm No. 1 (Western), $26,315; No. 2 (Eastern), $28,860; No. 3 (Eastern), $30,245; No. 4 (Eastern), $30,875; No. 5 (Western), $31,780; No. 6 (Western), $34,254; No. 7 (Eastern), $32,465.

The total weight of the five gates, according to several of the bidders, was approximately 277,000 pounds. The western concerns are all located west of the Rocky Mountains. The eastern concerns are all located east of the Mississippi River. The quotations show a wide variation, and it is not at all likely that any bidder had a sufficient advantage over any other, either in less cost of labor, less burden, less cost of material, or a combination of all, to account for the differences in the quotations. The work was of such a nature that special shop equipment could not have contributed materially to the assistance of the lower bidders, and a combination of all the favorable conditions could not account for the differences in the bids.

Presumably the western manufacturer had to pay freight on his material from the east, and this freight would be less on the raw material than the eastern manufacturers' freight on the finished slide gates. If bids 3 and 4, which are the closest, are consistent for eastern production, then bid 5 is fairly consistent with them as the extra $900 would allow for freight on the material from the east. Bid No. 1 would be very low for western production, and bid No. 2 would be low for eastern production if bids 3 and 4 are consistent for eastern production. Bid No. 6 is high for western production, and bid No. 7 high for eastern production.

Factors That Enter into the Estimate

There are three variable or unknown quantities that enter into the estimates upon which these quotations were based, and they are profit, overhead, and shop efficiency. The material cost is fairly well established, and will not vary much for all the bidders when freight is taken into account. Assuming that bids 3, 4, and 5 are consistent and the variables reasonably close, and a fair profit has been added, then it is a reasonable assumption that bidders 1 and 2 either had no profit added or have exceptionally low overhead costs and a high shop efficiency or would have sustained a loss on account of estimating low labor quantities. Bidders 6 and 7 either would have made an abnormal profit or are working under the handicap of abnormally high overhead or poor efficiency, or they made high labor estimates.

In estimating a job of this kind it must be taken into consideration that the work is to be done for the government and has to pass a very rigid inspection. The tests on the material are exceedingly rigid, and the specifications must be adhered to, both as to analysis and physical tests. These factors must be taken into consideration in making a time study, as such a time study must cover workmanship on material that is likely to be rejected.

The purpose of this article is to demonstrate how an estimate can be made with some degree of accuracy and to describe the method of estimating the labor and of using previous cost data as a basis, but the estimated amount of labor for this job will not be given, since it is not required in demonstrating the method of procedure. Lack of space forbids showing the complete estimate and time study made on this job, as well as the detail drawings of the gates, and this information would not serve any useful purpose. It is the desire of the writer merely to illustrate the method of carrying out the idea, and it will not be necessary to give the actual data compiled in the time study of this job.

Information Recorded on Time Estimate Sheet

The form used by one bidder for the time estimate sheet is a print from a Van Dyke made on ordinary blueprint paper. This permits changing the form to suit varying conditions, and obviates carrying a large stock of different printed forms. The exact arrangement of the time estimate sheet will vary more or less in different plants, especially on that part used to record the time of different machines, since the headings on the sheet conform to the equipment in the shop.

The sheet used by the particular bidder mentioned gave the following information: First, un-

der the heading "Pattern Shop" the number of hours and number of feet of material used for each pattern are recorded; then follows the respective pattern numbers. The general heading "Foundry" includes the time (number of hours) required by the molder and his helper, the core-maker and his helper, the cleaning time, and the total number of hours. Then follows the drawing number; the piece number; material; the total number of pieces; the part name; and finally, the general heading "Machine Shop," under which the various machine tools are listed, with the numbers of hours required for each machining operation. Thus, if three machine tools were used on a given part, the time (hours) is entered under the heading of each particular tool, and then at the extreme right the total machining time for each part is given.

No money values are given, as the pricing of labor comes within the province of another department than the one that keeps the costs and makes the time studies upon which the value of the work is based. It is the privilege of the members of the pricing department to make such changes in the labor estimate as they may deem advisable, either to add to the time estimate or make deductions as experience may dictate. The cost of the material is added to the estimate by the pricing department. The scheme of estimating laid out here is in successful operation in a large machinery manufacturing concern. It may not admit of making estimates that will always get the job, but as far as can be observed, it has minimized the amount of contracts that have been taken at a loss. Profit and overhead must, of course, be calculated and added by the pricing department.

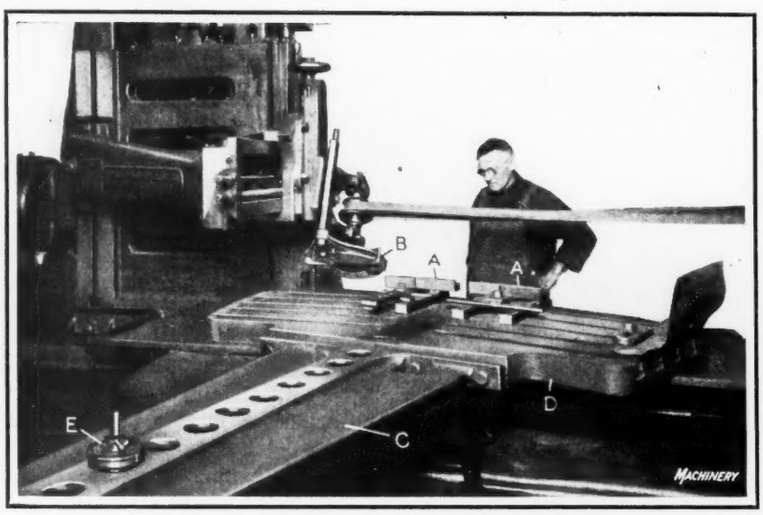
The machine tools and other facilities available for the work are always taken into account in making the time study. When a time study has been made on a job and the job has been secured, the time study sheet is segregated for the different departments, and each department is given the schedule of hours within which it is supposed to do the work. The time study is a combination of actual time data, when such data are available, and a time estimate made by the foreman of the department, working in conjunction with the men who have the actual compilation of the time study sheet. When the cost data available do not give the information required, it is necessary for the estimator and the shop foreman to get their heads together and analyze the parts of the job upon which no data are available.

The writer has seen estimates, and assisted in making them, where the time ran into many thousands of hours, and in such cases, the matter of machine tools available for the work was always taken into consideration. As mentioned in connection with this time estimate sheet, it is obvious that the equipment will vary in different shops, and it is necessary to consider this in the estimate. It seems evident that if all the bidders on this slide gate job had based their estimates on a time study like the one described, the bids would have been much closer together and more in accord with commercial requirements.

* * *

GRINDING PARTS TO A LARGE RADIUS

Parts are accurately ground to large radii in the Schenectady, N. Y., plant of the General Electric Co., by employing the open-side type of machine here illustrated. In the particular operation shown, one surface of the parts at *A* is being ground to a radius of 7 feet within 0.003 inch. The grinding is performed by the wheel of the Brown & Sharpe grinding head *B*, which is mounted on the regular cross-rail head of the machine. As the table reciprocates longitudinally, arm *C* swings fixture *D* back and forth to carry the work past the grinding wheel at the desired radius, the arm being pivoted at *E*.



Grinding Two Parts to a Radius of Seven Feet within 0.003 Inch

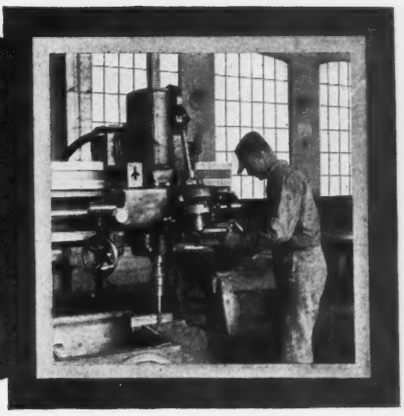
Various holes are provided along arm *C* to permit altering the distance from the pivoting point to fixture *D*. The outer end of arm *C* is supported by the finished surface of a circular casting connected to the right-hand end of the bed. A separate motor is used to drive the grinding wheel. In addition to grinding, this machine can also be employed for facing parts to large radii, by substituting the proper tool on the cross-rail head.

* * *

PROGRESS IN SIMPLIFICATION

The Division of Simplified Practice of the Department of Commerce, in its quarterly report, states that 686 trade associations of manufacturers, distributors, and consumers have accepted the 57 recommendations adopted by industries up to the close of the quarter; also that 9 other associations have accepted recommendations "in principle," even though not directly connected with the industries affected. More than 2775 individual firms have accepted the recommendations. About 200,000 copies of Simplified Practice Recommendations have been purchased by trade extension bureaus, corporations, trade associations, and others, for the information and guidance of engineers, buyers, consumers, and the like.

Letters on Practical Subjects



CROSS-SLIDE TOOL-BLOCKS

The cross-slide tool-blocks shown in Figs. 1 and 2 are used on a turret lathe in machining brass castings like the one shown at *W*, Fig. 1. The finished surfaces are required to be held to close limits, particularly with respect to dimension *Z*. The hub of the casting is held in the chuck, and the hole and the rim are finished with standard turret lathe tools.

The tool-block for the roughing tools, shown in Fig. 1, is clamped to the back side of the cross-slide. The tool bits *A* are ground on the sides for clearance, as indicated, and are kept in stock ready for use. They are held in place by the clamps *B* in slots at a 5-degree angle. This brings the points of the tool bits into the proper position for facing the sides of the work. As these tools do not take heavy cuts, they are not backed up in any way, the clamps *B* providing ample holding power.

The finishing tool-block (see Fig. 2) holds the tool bits *C*, which are located in slots cut at an angle in plate *E* and clamped by blocks *D*. These tool bits are ground for clearance on the sides, and are closely fitted into the slots, as shown in section *X–X*. The slots are cut in such a manner as to give the correct dimension *Z*, as shown, when the tool bits project a certain distance from the blocks. As it is necessary to hold this dimension within very close limits, a fine adjustment of the distance between the points of the tools is required. This adjustment is obtained by cutting a 1/8-inch slot *P* in the plate *G* midway between the tool bit slots. This leaves the plate in two parts *F* and *G*, which are connected by a narrow section *H*. Plate *E* is held in place on plate *J* by machine screws and dowel-pins grouped in part *F* of the plate.

The bolt *K* is a loose fit in part *G*, and it is screwed into part *F*, as indicated. By tightening this bolt, the two parts of the plate are sprung together a few thousandths of an inch, thus bringing the ends of the tool bits that much closer together. Loosening the bolt causes the tool bits to spring away. Plate *J* which contains the above arrangement is a dovetail slide fit in the block *L*, and can be adjusted back and forth by means of the adjusting screw *M*. The block *L* is clamped to the front side of the cross-slide of the machine. The tool bit *N* is located in block *J* at the correct position to give a slight chamfer to the back edge of the casting.

New York City — B. J. STERN

TURNING CAMS ON A LATHE

In an article entitled "Turning Cams on a Lathe" on page 51 of September MACHINERY, it was stated that a cam could be turned to the contour of the master cam with a set-up similar to the arrangement shown in Fig. 1. This statement is incorrect, as will be evident from a consideration of the illustrations shown herewith. With the attachment suggested in September MACHINERY, the

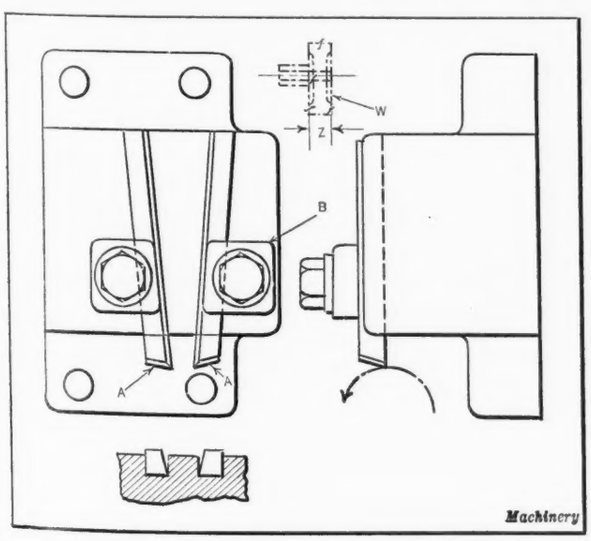


Fig. 1. Tool-block for Holding Roughing Tools

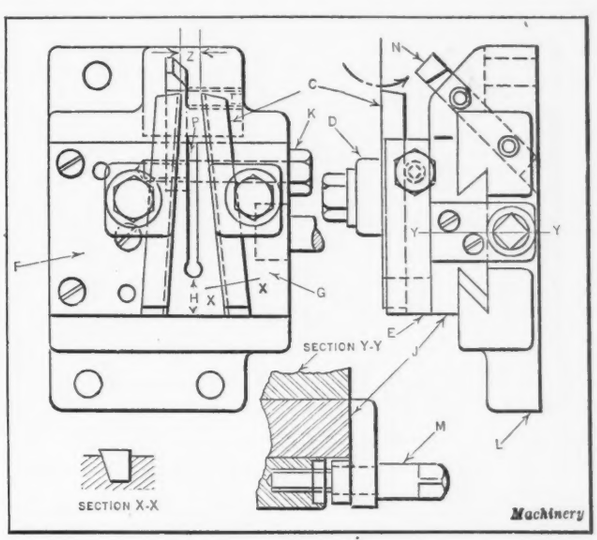


Fig. 2. Tool-block for Finishing Tools

cam would be cut somewhat larger than the master cam, the amount of variation depending on the size of the roll in contact with the master cam. Only two points on the cam, located at the maximum and minimum throw positions, as at *X* and *Y*, Fig. 2, would be the same distances from the arbor as similar points on the master cam.

The operation in Fig. 1 is used by the writer in his capacity as director of training at the Western Clock Co.'s plant, La Salle, Ill., as a problem for the apprentices. One problem is to determine the finished shape of *A*, when *F* is an eccentric; the other problem is to determine shape of *F* when *A* is to be a true circle. In diagram *A*, Fig. 2, the path of the tool point is shown by the heavy line. It is clear from this diagram that the outline of the work is larger than the outline *D* of the master cam. Roller *R* rolls on the master cam *F* along its periphery *D* and the point of tangency *T* is on a line drawn between their centers. The tool *S* always points toward the center of mandrel *H*, and cannot therefore be on the point of tangency between the master cam and the roller, but during the greater part of the revolution of the work will be outside the line representing the master cam, as indicated by the heavy line that represents the path of the tool point.

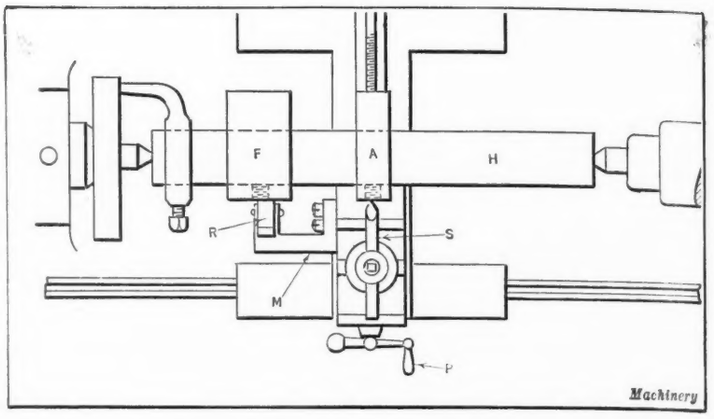


Fig. 1. Plan View Showing Inaccurate Method of Turning Cam

When it is desired to cut an eccentric or cam *A*, Fig. 1, using a given size of roller *R*, a master cam *F* can be produced or laid out by the method indicated in diagram *B*, Fig. 2. In this case, it will be noted that the outline of the master cam is smaller than the outline of the work except at the two points *X* and *Y*.

La Salle, Ill. U. ROY SEWREY

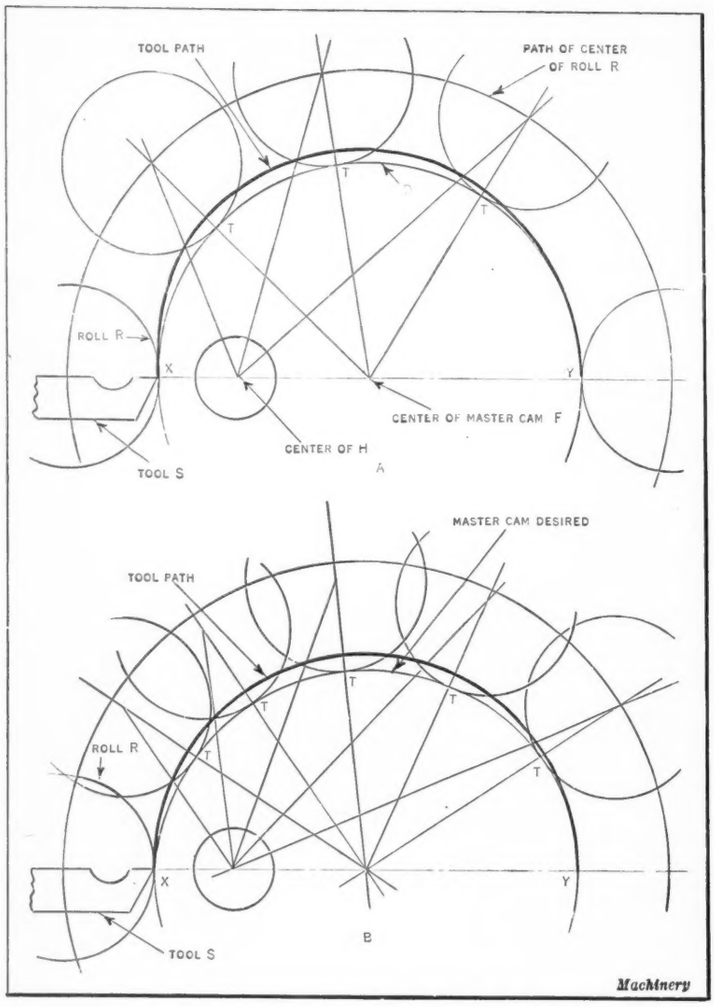


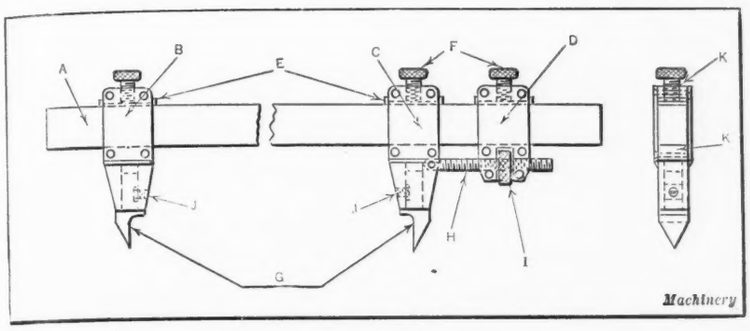
Fig. 2. Diagrams Illustrating Problems in Cam Turning

BEAM TRAMMELS FOR ACCURATE WORK

On many classes of machine work, it is necessary to lay out large radii to close limits. The trammel, or beam compass, shown in the accompanying illustration, while of simple construction, can be readily set to accurate measurements by means of a micrometer, vernier caliper, size-blocks, end measuring rods, etc.

The beam *A* is simply a piece of 1/4- by 3/8-inch cold-drawn steel rod of the desired length. The construction of slides *B* and *C* is clearly shown. Pieces of 1/4-inch steel *K* are sandwiched between pieces of 1/16- or 1/32-inch sheet steel, and riveted in place. The upper parts of the slides are tapped to fit knurled setscrews *F*, and the lower parts have a 1/8-inch reamed hole to accommodate the scribing points *G*. The fine-adjustment slide *D* is similar to the two tram slides, except that it has a clearance hole drilled through it lengthwise to fit adjusting screw *H*, and a slot at right angles to the adjusting screw to accommodate the knurled nut *I*.

One end of screw *H* is pinned to slide *C*. To guard against marring the beam, pieces of sheet metal *E*, bent up at the ends as shown, are placed between the screws *F* and the beam. The scribing points *G* are pieces of 1/4-inch drill rod, one end of which is turned down to fit the 1/8-inch hole in the slides, and the other end turned to an angle of about 55 degrees. The points are cut down nearly to the center line and hardened. After the points have been hardened and tempered, the flats are ground right to the center line. A slight flat should be cut on the shanks of the scribing points for



Beam Trammel of Simple Construction

the set-screws *J*, which serve to keep the flat sides of the scribing points parallel.

It will readily be seen that by measuring between the flats of the two scribing points, the tool can be accurately set. When the points are in the position shown, they can be set by means of inside micrometers, end measuring rods, vernier calipers, size-blocks, etc. In order to set them by means of outside micrometers, it is only necessary to reverse the points, so that the flats face outward. This form of scribing point gives a sharp distinct impression, and the entire tool is compact and rigid.

Bronx, N. Y. PHILIP F. SHAFRAN

ALLOWANCE FOR BENDS IN SHEET METAL

As considerable sheet metal was being wasted in our plant through the necessity of ordering blanks somewhat larger than were actually needed, to compensate for bends, it was decided to calculate the exact sizes required and thus eliminate the necessity for trimming the work. Accordingly, the accompanying chart was prepared for calculating the length of stock required for parts having any given number of bends or corners. As the bending was done in a forming press, close account was kept of the length of stock, thickness of stock, corner radii, and angle of bend. After records covering a considerable number of pieces had been obtained, it was a simple matter to prepare the chart from the figures obtained in actual practice.

Rochester, N. Y. EDWARD T. HEARD

CLEARANCE FOR PIERCING PUNCHES

A source of trouble in piercing holes in brass and other soft metals is the tendency of the slugs to follow the punch out of the die on the up stroke and drop on the top or face of the die. This difficulty is often experienced when the piercing holes are made according to the usual practice of having the diameter of the hole larger than required by an amount equal to 6 per cent of the thickness of the stock. According to this practice, the clearance around the punch for 1/8-inch brass stock is about 0.005 or 0.006 inch. If this rule is followed and the pierced hole is very smooth, the slugs are quite likely to come back through the hole and drop on the top of the die.

This difficulty may be eliminated by giving the piercing hole a clearance of only 0.002 or 0.003 inch instead of 0.005 inch. If the piercing holes are reamed out with a tool that is not very sharp, there will be less likelihood of the slugs coming out on the top of the die. In the case of aluminum, the clearance should be less—say about 0.001 or 0.002 inch. For piercing copper, the clearance can be slightly greater—about 0.002 or 0.003 inch. Cold-rolled steel stock does not give any trouble with the usual clearance.

Newark, N. J. JACOB H. SMIT

AN IMPROVED RATCHET MOVEMENT

The accompanying illustration shows a simple change in a ratchet movement which resulted in a more positive action. Originally, the arrangement was as follows: The ratchet wheel *A*, which is keyed to the shaft *F*, served to impart motion to a sliding table (not shown). The motion of the shaft *F* was imparted to the table by means of gearing engaging with a rack on the under side of the table. The lever *B* was given an oscillating motion by a crank, to which it was connected by the connecting-rod *E*. The pawl *C*, pivoting on the stud *I*, engaged the ratchet wheel *A*, the weight *H* serving to keep the pawl engaged. Originally

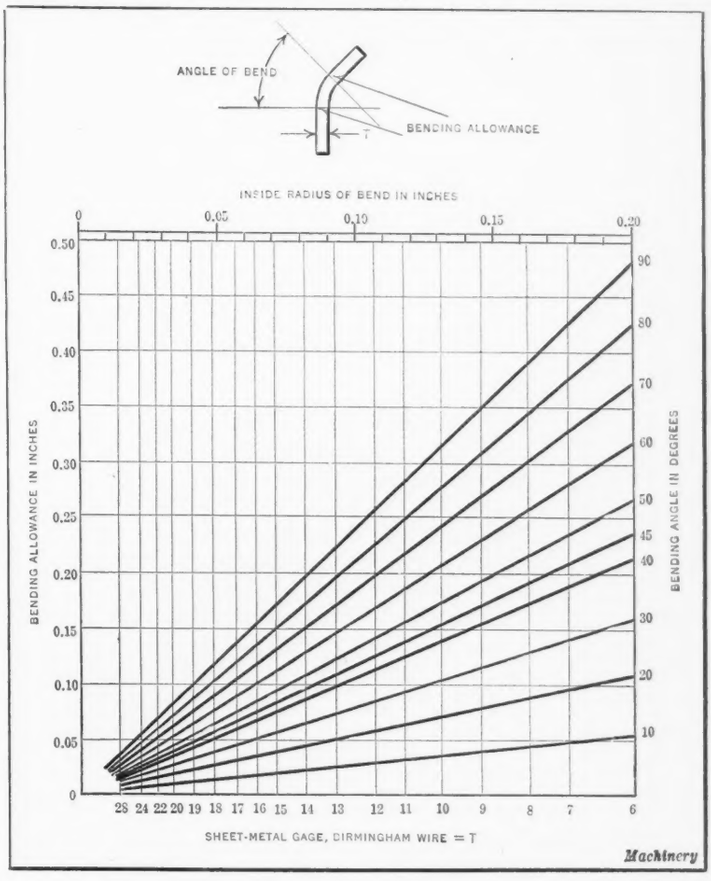
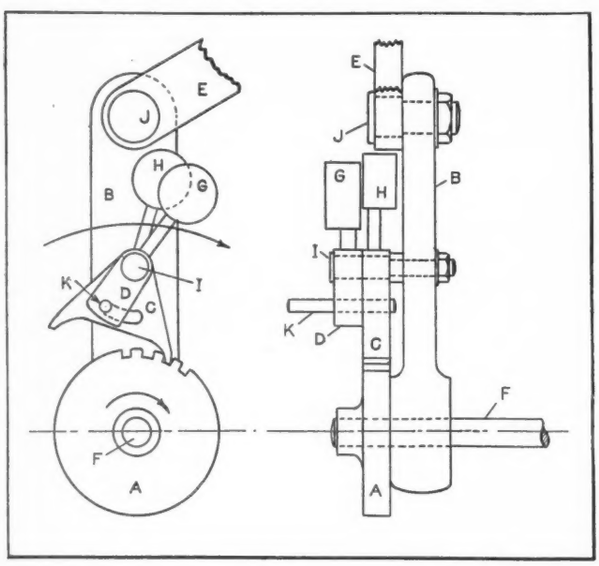


Chart for Determining Allowance for Bends in Sheet Metal—In Using Chart, Pass From Point on Horizontal Scale Denoting Gage of Metal, Up to Inclined Line Denoting Angle of Bend, and Thence to Left Scale

pawl *C* was not slotted as shown, but carried pin *K*, the part *D* with its weight *G* not being used. As the table moved along, a dog on the edge struck pin *K*, and swung pawl *C* to the opposite side, reversing the rotation of shaft *F* and the movement of the table.

In general, this arrangement operated satisfactorily, except on rare occasions, when the position of the dog on the table would be such as to swing pin *K* just far enough to balance pawl *C*, when the movement of the table would stop until reversed by the operator.

In order to overcome this condition, pawl *C* was slotted as shown, and the part *D* was added, pin *K* being a press fit in part *D* and sliding in the slot in pawl *C*. With this arrangement, pawl *C*, operating independently of part *D*, remains in contact with ratchet wheel *A* until the table has moved



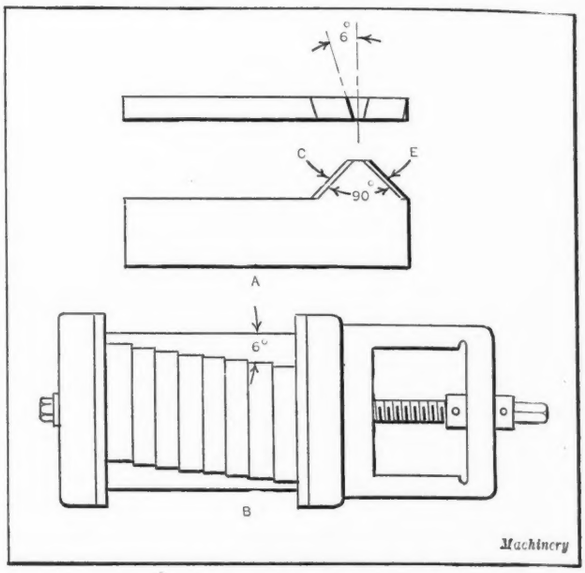
Improved Ratchet Movement

far enough to push pin *K* over so that weight *G* falls on the opposite side, the unbalanced effect causing pawl *C* to swing on stud *I*, and engage on the opposite side, producing a more positive effect than by swinging the pawl direct.

Philadelphia, Pa. R. H. KASPER

MAKING FORMING CUTTERS ON THE SHAPER

The method of holding blank cutter blades to obtain the required clearance described in September MACHINERY on page 51 calls to mind a method used by the writer in a plant manufacturing ball bearings. One of the cutters used in the ball bearing plant is shown at *A* in the accompanying illustration. These tools were used for turning bevels on bearings. Originally it was the practice to form the bevels *C* and *E* on these cutters, one at a time, in the shaper. After machining the edges and sides, the writer placed twelve of the cutters in a shaper vise, and with a protractor, set them at an angle of 6 degrees with the vise jaws, as shown at *B*. The vise was then swung around to an angle of 6 degrees, and one side of the row of tools machined, after which the vise was swung around to a position 6 degrees the other side of the center



Method of Holding Cutter Blanks on Shaper to Obtain Clearance

line, and the opposite side of the row of cutters machined. The shaper tool was, of course, fed down at an angle of 45 degrees.

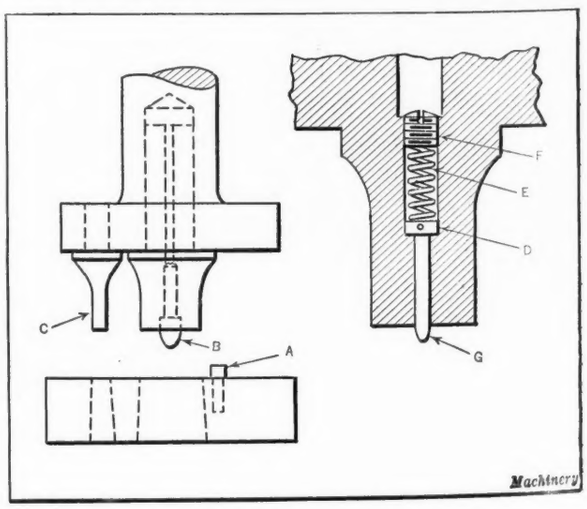
Philadelphia, Pa. CHARLES KUGLER

SPRING-BACKED PUNCH PILOT

In operating a progressive punch and die, such as shown in the accompanying illustration, the stock is sometimes fed either past or not up to the stop-pin *A*. When this happens, the pilot *B* descends upon the solid stock, instead of entering the hole previously pierced by the punch *C*, which may result in breaking the punch or damaging the die.

Trouble of this kind can be eliminated by employing a pilot similar to the one shown in the view at the right-hand side of the illustration. The pilot *G* is made a sliding fit in the punch, and has a collar *D* held in place by a pin that acts as a stop. The spring *E*, which is held in place by the screw *F*, keeps the pilot in position under normal operating conditions, but allows it to recede into the body of the punch when it strikes the solid stock, so that neither the pilot nor the punch is damaged.

Pawtucket, R. I. S. W. BROWN

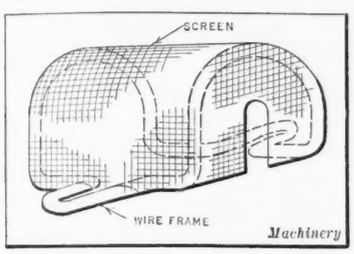


Progressive Die and Spring-backed Pilot

Shop and Drafting-room Kinks

WIRE ENCLOSURE FOR MOTOR

Some months ago, a small bench motor employed to drive a drill press was enclosed for protection against chips and against tools being accidentally dropped on it, by a sheet-metal case, attached to the bench by two small screws. With this sheet-metal case, the motor became so hot that the insulation on the field and armature coils was damaged. To eliminate this trouble, the shop foreman devised the cover shown in the illustration. This improved cover not only gave the motor ample protection, but also provided sufficient ventilation. This cover is made from ordinary screen wire, with small 1/4-inch wire stock bent around the corners to hold the screen in place. This idea is simple, and applicable to both large and small motors where good ventilation and protection is required.



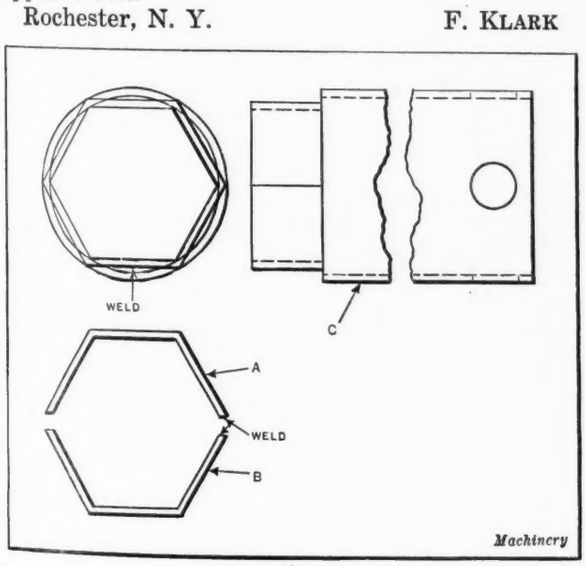
Enclosure for Small Motor

Washington, D. C. G. A. LUERS

INEXPENSIVE SOCKET WRENCH

In making socket wrenches for large hexagonal nuts, especially those made of brass or copper where a pipe cannot be forged around the nut, it is the practice to make a drift for forming the cavity. A less expensive method of constructing a socket wrench is to bend pieces of iron, 1 inch wide by 3/16 inch thick, to the shape shown at *A* and *B* in the accompanying illustration. The two halves *A* and *B* are then welded together and joined to the piece of pipe *C*, as indicated in the upper views.

Rochester, N. Y. F. KLARK

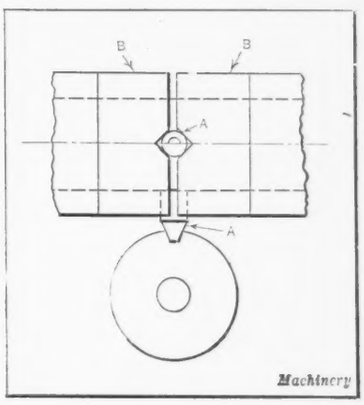


Inexpensive Method of Making a Socket Wrench

FLY CUTTER FOR CUTTING SMALL GEAR

Some time ago the writer found it necessary to replace a small steel gear that was not badly worn but that had some broken teeth. As there was no milling cutter available, a fly cutter was made like the one shown in the accompanying illustration.

The cutter *A* is a short piece of drill rod which was gripped in a spring chuck and machined on the end to fit one of the tooth spaces in the old gear. After forming the end of the drill rod to the required shape, one-half of the metal was cut away. The cutter thus produced was then hardened. The manner of holding the cutter between the collars *B* on a milling machine arbor is shown in the illustration. The work was carefully fed to the cutter, and the resulting gear was very satisfactory. The cutter *A* is shown in two positions for the sake of clearness, only one cutter, of course, being used.



Method of Holding Fly Cutter

South Meriden, Conn. D. F. MORIARTY

SLIDE-RULE KINKS

The possibilities of the slide-rule are not always fully realized or taken advantage of. For instance, if proportions are figured on the A-B scales, a great deal of time and labor can be saved, because it is not necessary to turn the slide end for end, as is commonly done in the routine figuring of proportions. There are few cases in which greater accuracy makes it necessary to use the larger C-D scales, and often there will be greater assurance of obtaining the correct result when using the A-B scales, as errors that might creep in during the reversing of the slide are avoided.

Another interesting example occurs in reading the percentage of difference between two figures. The difference between two quantities expressed in terms of percentage can be figured in two ways—from the smaller figure up or from the larger one down—and it is not generally realized that both readings appear simultaneously on the slide-rule when using the C and D scales. For instance, how much larger is 36 than 26, and how much smaller is 26 than 36? To 36 on scale D, set 26 on scale C. Now on the left-hand end of the rule on scale D appears 1385. Disregarding the 1 we read 38.5, or 36 is 38.5 per cent larger than 26. At the same time to the right on scale C there appears, reading backward, 278. Therefore, 26 is 27.8 per cent smaller than 36. HENRY SIMON

Questions and Answers

EMPLOYER'S LIABILITY FOR INJURIES TO EMPLOYE

S. T. P.—What is considered the place of work or the factory premises on which, when an employe is injured, he may recover damages for the injury?

Answered by Leo T. Parker, Attorney at Law

A.—The "place of work" legally extends and includes such parts of the premises or factory as the employer has prepared for occupancy, and to such other parts as he knows or is expected to know that the employes are accustomed to using while performing their work; but an employe is not entitled to a judgment for damages where it is proved that he was not acting within the scope of the employment, even if he is injured on the factory premises. Yet it has been held that an employe is still within the scope of the employment when he temporarily quits his work to obtain a drink of water, to rest, to get a breath of fresh air, to get warm, and other similar instances.

CONDUCTIVITY CHANGES DUE TO LIGHT

N. M.—What electrical conductor changes its conductivity in accordance with changes in the intensity of light to which the conductor is subjected?

A.—Selenium, which is one of the non-metallic chemical elements, possesses the peculiar quality or property of having its conductivity greatly increased by light. This property has been the basis of many electrical inventions, as for example, in various forms of apparatus for transmitting photographs by wire. Selenium has also been used in instruments for measuring the Roentgen rays used in therapeutic applications; in a form of Wheatstone bridge; in appliances intended to light and extinguish automatically the flame on gas buoys; in controlling street lights, electric signs, and moving pictures; in burglar alarms; and in controlling submarine boats. Selenium is used very largely in the making of glass, to which it gives a red color. It is also used to give a bright red color to enamels used on "enameled ware." The atomic weight of selenium is 79.2. Its specific gravity is 4.8, and it melts at a temperature of 217 degrees C. (423 degrees F.). Its specific heat varies from 0.072 to 0.115.

PERCENTAGES OF IRON IN IRON ORE

G. F.—About what percentage of iron does iron ore contain? Is this percentage fairly uniform for ores taken from different mines?

A.—Iron ore contains ordinarily from 35 to 65 per cent of iron, and, in addition, oxygen, phosphorus, sulphur, silica (sand), and other impurities. If the ore contains less than 40 per cent of iron, it must first be concentrated, and, if less than 25 per cent of iron, it is not considered a commercial product, owing to the excessive cost of smelting. At the present time, the ores mined in the United States average slightly over 50 per cent of iron, although the "Lake" ores sometimes contain over 60 per cent. Iron ores which consist of carbonates—minerals in which iron is present with oxygen and carbon—and sulphides—minerals in which the iron is present with sulphur—are also used, but these ores must be roasted to drive off the carbonic acid of the carbonate ore and reduce the sulphur in the sulphide ore. Iron ore in which sulphur is present to an amount exceeding 1 per cent must always be treated in this manner. Magnetite is an ore that has derived its name from the fact that it is attracted by the magnet. In magnetite ores, iron is present as a magnetic oxide, Fe_3O_4, which, when pure, contains 72.4 per cent of iron.

Magnetite is the purest form of iron ore found in nature, and contains the largest percentage of iron obtainable in any ore. Many of the commercial magnetite ores, however, contain, as impurities, sulphur, phosphorus, and titanium, and sometimes the ore is mixed with an excess of rock, making the actual percentage of iron for a given weight comparatively small. Magnetite ore, when pure, is almost black, but the commercial ore varies in color from black to blue black, steel gray, or slightly green, having a hardness of from 5 to 6.5 on the Mohs hardness scale. Hematite ore, also frequently known as "red hematite," is an iron oxide of the composition Fe_2O_3, containing about 70 per cent of iron. Approximately, 93 per cent of the iron ores mined in the United States belong to this class. The color of hematite varies from a bluish gray to a deep red, but it always gives a red streak on a porcelain plate. The hardness of hematite varies from 5.5 to 6.5 on the Mohs scale. The specific gravity varies from 4.2 to 5.3. Hematite is an anhydrous oxide containing no water in combination after having been heated to a temperature of 212 degrees F.

* * *

BRONZE-WELDING OF CAST IRON

"As recently as four years ago," says *Oxy-acetylene Tips*, "bronze-welding as a method for repairing gray iron castings was practically unknown outside of a few large railroad shops and industrial plants. Today a great deal of this work is being done. The bronze welding method is now employed to a considerable extent on light sheet steel, steel plate, cast-iron pipe, and copper. In fact, about the only commercial metal that is not bronze-welded is aluminum." The subject of bronze-welding has been completely discussed in the pages of *Oxy-acetylene Tips*, published by the Linde Air Products Co., 30 E. 42nd St., New York City. The article in the October number of this publication will be of particular interest to those engaged in this special line of work.

Designing a Welded Steel Machinery Base

By ROBERT E. KINKEAD, The Lincoln Electric Co., Cleveland, Ohio

THE redesigning of cast-iron machinery bases in order to substitute welded steel seems rather complicated to many who are not familiar with the subject; however, the method can be summed up in a few words: Replace cast-iron beam sections with steel beam sections of the same depth but of only one-half the weight. Weld the steel beams together to get the desired shape for the base; then weld steel lugs cut from angle sections to the steel beams and drill the lugs to take foundation bolts. Use steel bar stock for mounting pads, and weld the pads where needed on the steel beams. This method, which will be described more in detail, is that followed generally by the engineering department of the Lincoln Electric Co. The cast-iron base selected as an example to show the procedure in designing (Fig. 1) cost $66, whereas the steel base (Fig. 3) that replaced it cost $11.75.

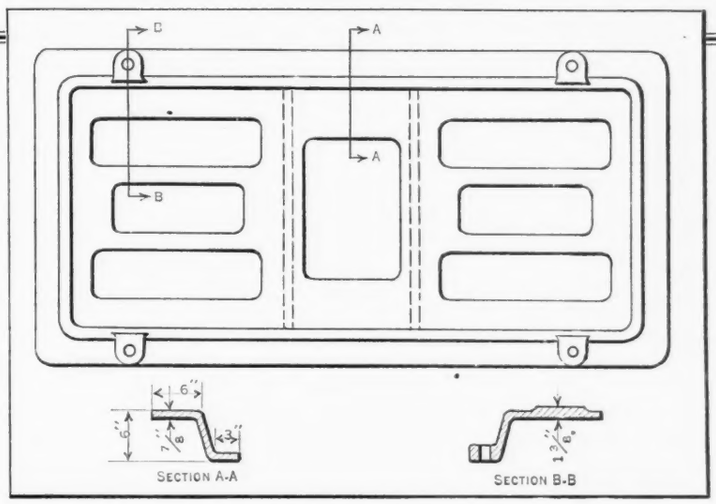


Fig. 1. Cast-iron Base Used as Example to Illustrate Method of Redesigning for Welded Steel Construction

The primary purpose of a base is to hold the machinery mounted on it in the proper alignment under operating conditions. The secondary purpose is to provide a rigid mounting, so that the machinery can be shipped assembled, without danger of having its proper alignment destroyed. A third consideration is that the base shall be so designed that it may be installed on its foundation and bolted down without destroying the alignment of the mounted machinery. These objects should be attained with a minimum cost.

The base under consideration, in the absence of information to the contrary, may be assumed to meet the requirements mentioned in every respect except the matter of cost. The problem, therefore, is merely to produce a steel base having the same stiffness and strength as an existing cast-iron base. While the cast-iron base may be stronger and more rigid than is actually necessary, this does not affect the problem, as it is merely required to reproduce an equivalent base in welded steel at a reduction in cost. No calculations or estimations need be made of the loading on the base or the material provided to support the loading, since it is assumed at the outset that the cast-iron base, under the most severe conditions, is satisfactory for the purpose. The only requirements are to provide sufficient steel and to place it in such a manner as to give equal stiffness, strength, etc.

To illustrate the simplicity of designing a welded steel base to replace one of cast iron, an analysis of a typical case will be presented. The technical data on the cast-iron base is given merely for the purpose of comparison.

The base illustrated in Fig. 1 was designed to be made from cast iron. Two machines, each weighing 2500 pounds, are to be carried on this base. The center of gravity of each machine is 24 inches from the transverse center line of the base. It was calculated, in the original base design, that under the unfavorable condition shown in Fig. 2, the maximum allowable deflection produced by the static load on the base should not exceed 0.008 inch. (Note that only one-half of the base is supported by the foundation.) This is the base deflection caused by the 2500-pound machine that stands on the unsupported end of the base and is not coupled to the other machine. If the machines were coupled under this condition, there would be considerable binding in the bearings. The 0.008 inch base deflection is taken as the limiting condition.

With the design shown and under the conditions stated, the maximum stress at point *T* (Fig. 2) is 6000 pounds per square inch. The modulus of elasticity for cast iron at this stress is taken as 13,500,000. It is apparent from the illustration that if the nuts on the foundation bolts were tightened, the stress would soon reach a value where the base would be broken, and comparatively slight

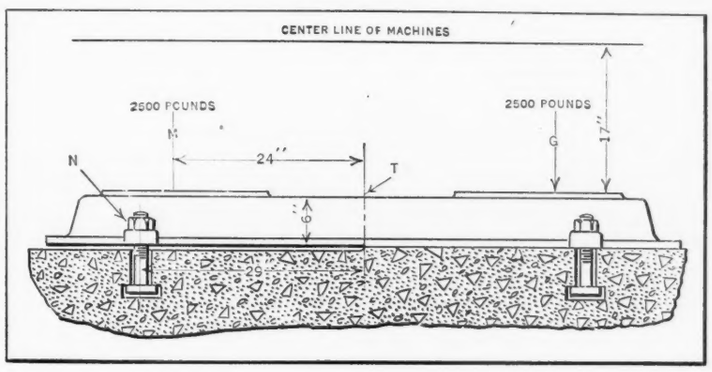


Fig. 2. Diagram Illustrating Loading Conditions and Basis for Determining Maximum Allowable Deflection

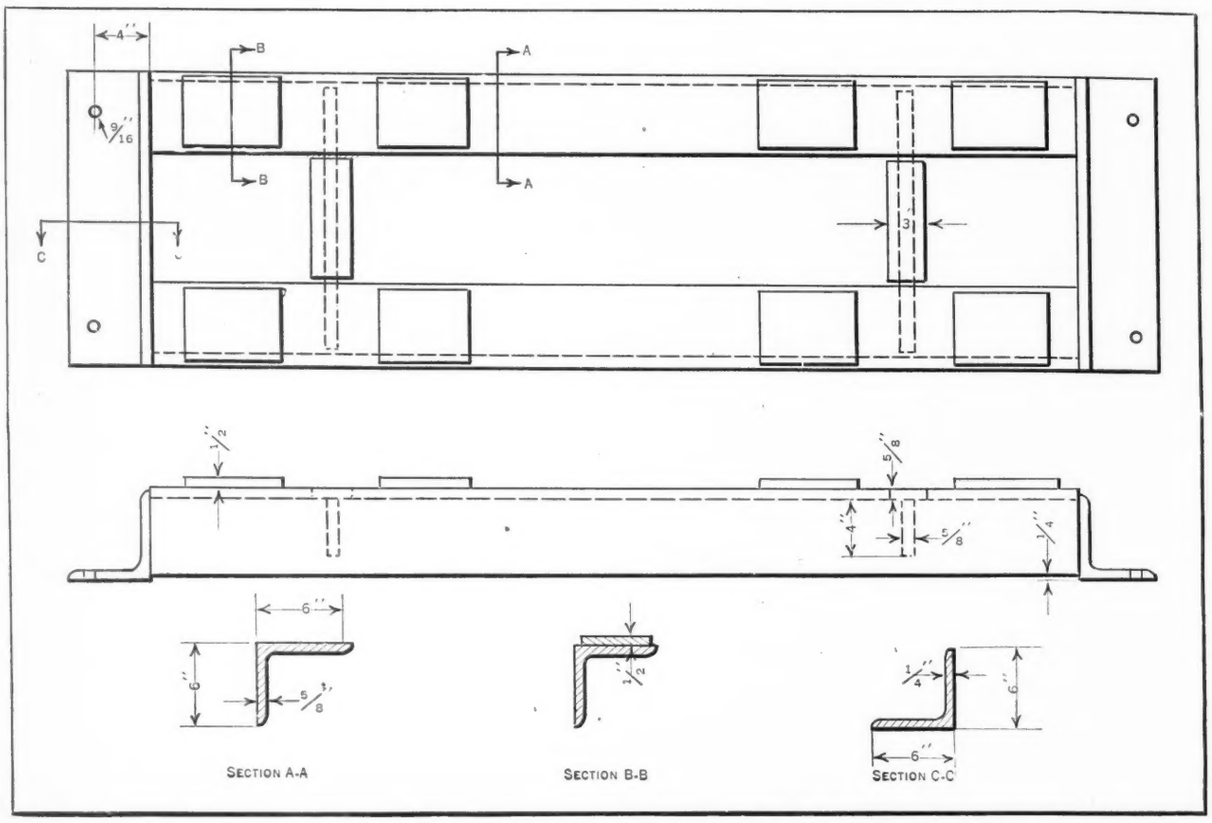


Fig. 3. Steel Base which Cost $11.75 or $54.25 Less than the Cast-iron Base Shown in Fig. 1

pressure would distort the base beyond the predetermined limits. The base is not designed for such pressure, in spite of the fact that the design permits such pressure to be applied. This is a defect in the design, but one that it is practically impossible to avoid in designing a cast-iron base.

Fig. 3 shows a base of equivalent stiffness made of standard steel angles welded together. The size of the angle side members may be determined in the manner to be described, though the use of the formula is merely a demonstration of the "rule-of-thumb" method in transferring from cast iron to steel in beam sections; the rule followed is to keep the depth of the beam the same but reduce the thickness by 50 per cent.

A beam formula will be applied first to the cast-iron base (Fig. 1) to determine the moment of inertia of the section required to meet the loading conditions. Assume

D = maximum deflection of base = 0.008 inch;

W = load on each side of base = 2500 pounds;

l = length from transverse center line of base to center of gravity of load = 24 inches;

E = modulus of elasticity = 13,500,000 for cast iron; and

I = moment of inertia of beam (both side rails in this case).

$$D = \frac{Wl^3}{3EI} = 0.008 = \frac{2500 \times 24^3}{3 \times 13{,}500{,}000 \times I}$$

Therefore, $I = 107.6$ inches^4

To calculate the moment of inertia of the beam section of the steel base, we may solve the same formula substituting the modulus of elasticity of steel for that of cast iron. Thus,

$$D = \frac{Wl^3}{3EI} = 0.008 = \frac{2500 \times 24^3}{3 \times 30{,}000{,}000 \times I}$$

Therefore, $I = 47.4$ inches^4 and $I \div 2 = 23.7$ inches^4 (for each side rail). As a 6- by 6- by 5/8-inch angle has a moment of inertia of 24.2 inches^4, this size would be used.

The weight per foot of the cast-iron section at *A–A*, Fig. 1, is 49 pounds per foot. The weight of a steel angle of the same stiffness (a 6- by 6- by 5/8-inch angle) is 24.2 pounds per foot, which proves that equal stiffness can be obtained by the use of one-half as much steel as cast iron.

The steel base has the relatively limber angles at the ends, with holes for foundation bolts near the edge (see Fig. 3). The object of this design is to prevent distorting the base by tightening the

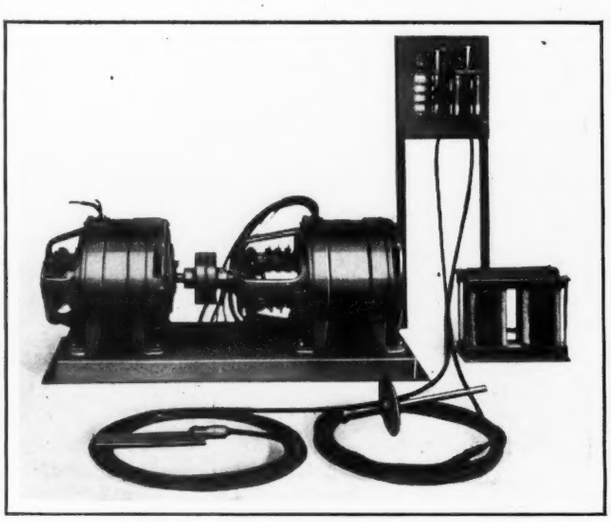


Fig. 4. Commercial Application of a Welded Steel Base which has Replaced a Cast-iron Base

nuts on the foundation bolts. The end angles will flex under pressure, but the base side rails will not bend. The object of foundation bolts is to prevent movement in a horizontal plane, and bolts through these comparatively flexible angles prevent such movement without distorting the base proper. Defective design in the cast-iron base is thus corrected in the steel design.

A summary of the relative costs follows: Weight of cast-iron base, 1100 pounds; cost at 6 cents per pound, $66. Weight of steel base, 470 pounds; cost at 2 cents per pound, $9.40. Welding of steel base, $2.35. Total cost of steel base, $11.75. Saving compared with cast-iron base, $54.25.

Fig. 4 shows a commercial application of a welded steel base which has replaced a cast-iron base.

* * *

NUT-SETTING AND SCREW-DRIVING CHUCK

One of the many worthwhile ideas received through the suggestion system of the General Electric Co., (which is described on page 352 of this number of MACHINERY) resulted in the adoption by the various plants of a new type of chuck for use in driving screws and in setting nuts and bolts. This chuck was designed by A. Niedhammer of the Schenectady Works, and functioned so satisfactorily in trials that it was adopted by the company. Four sizes are now standard equipment, the largest of which drives screws up to 5/8 inch into wood. A photograph of the chuck is reproduced in Fig. 1, and Fig. 2 represents a cross-sectional drawing.

The principal features of the chuck are that the amount of friction between the driving and driven members can be closely adjusted to suit each particular job, and that, as the screw or nut becomes tightened, a hammering effect is imparted to drive

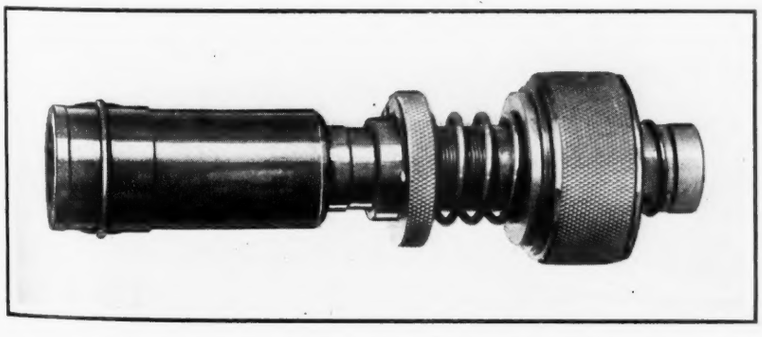


Fig. 1. Chuck that Gives Light Hammer Blows in Driving Screws or Nuts

it securely "home" without damage. From Fig. 2 it will be obvious that tang *A* is inserted in the spindle of a machine for driving the device and that the tang of a screwdriver or socket wrench is inserted into nose-piece *B*. The drive from tang *A* to the nose-piece is through part *C* and three balls *D*.

In starting to drive a screw or set a nut, balls *D* are held by plungers *E* in pockets spaced around the flange of the nose-piece. As the screw or nut is tightened in place, the power requirement increases until finally the pressure of spring *F* is overcome to such an extent that the balls withdraw

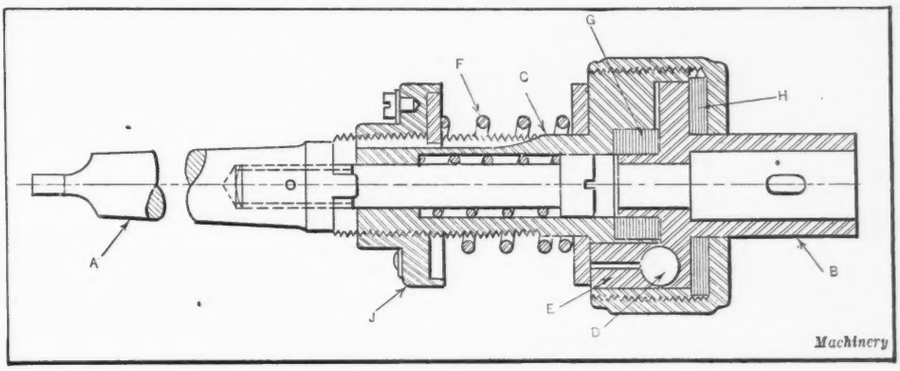


Fig. 2. Cross-sectional Drawing of the Chuck Illustrated in Fig. 1

from the pockets and move in a path around the flange of nose-piece *B*. The balls tend to reseat themselves in the pockets as they pass over them and this results in a rapid succession of light hammer-like blows, which drive the nut or screw securely into place. Packing at *G* and *H* absorbs the shocks. The pressure on balls *D* can be adjusted to suit a given job by merely revolving nut *J* along part *C* to increase or decrease the compression of spring *F*.

* * *

NEW HAVEN MACHINE TOOL EXHIBIT 1927

The seventh annual New Haven machine tool exhibition will be held in the Mason Laboratory, Sheffield Scientific School, Yale University, New Haven, Conn., September 6-9, 1927. In connection with the exhibition there will be a series of technical sessions dealing with new developments and problems in the design, manufacture, use and operation of machine tools. These technical sessions are under the direction of the Machine Shop Practice Division of the American Society of Mechanical Engineers.

The exhibition is sponsored by the New Haven Local Section of the American Society of Mechanical Engineers, the New Haven Chamber of Commerce and the Department of Mechanical Engineering of the Sheffield Scientific School of Yale University. The exhibition is operated wholly on a non-profit making basis by a committee of representatives of the above organizations who receive no compensation, but who are giving their time and effort to this work with the feeling that a worthwhile service is rendered the industry.

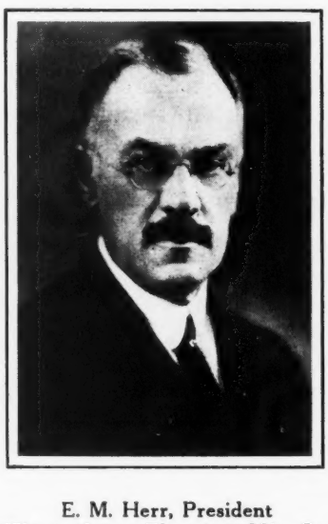
The decision to hold the exhibition this fall was based upon an expression of opinion obtained from the exhibitors in the fall of 1926, the idea being to hold the exhibit only in response to the expressed wishes on the part of those machine tool builders and accessory manufacturers who wish to avail themselves of the opportunity to exhibit. Harry R. Westcott, 400 Temple St., New Haven, is chairman of the exhibition committee.

THE ELECTRICAL INDUSTRIES*

By E. M. HERR, President
Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

The electrical industry has prospered during the year just closing, as have other industries. In forecasting what next year has in store, certain factors that will exert a favorable influence present themselves. The financial condition of the country is excellent. The railroads have been able to better the fine record for efficiency that they made in 1925. In that year, with a reduction of more than 10 per cent in the number of men employed, almost 15 per cent more loaded cars were handled than during the period of government operation. This record can be still further improved with better cooperation and a modification of some of the restrictive laws dealing with the railroads, which hamper freedom of movement and the initiation of broad executive policies. The Regional Advisory Boards, composed of farmers, manufacturers and distributors, are exerting and will continue to exert a beneficial influence.

The agricultural field has shown a material improvement during the past year, and there is every indication of still further improvement in the coming year. This will have an important bearing on industry as a whole, when we realize that the agricultural field supplies over one-third of the materials used in manufacturing—in terms of value.



E. M. Herr, President
Westinghouse Electric & Mfg. Co.

Several of our national organizations in the commercial and industrial fields have interested their members in the important work of waste elimination and simplification of lines of product, with favorable results. The work of the Department of Commerce in this line has been notable. The work is but begun, and the field for continued efforts presents almost unlimited possibilities.

For the electrical industry 1926 has been a good, but not an unusual year. There is every indication that the first half of 1927 will be equally good. When we consider the comparative youth of this industry, its growth covering a bare half century, and the rapid strides it has made in that short period of time, its possibilities for expansion seem very great.

With the continuing development of our transmission systems, which have made current available in many districts hitherto unserved, there is a rapidly expanding market for household appliances of all kinds. Recent statistics show that there are over 3,000,000 wired houses without electric irons, over 8,000,000 without fans, over 11,000,000 without toasters, and even more without coffee percolators, ranges, washing machines, vacuum cleaners, and other household appliances. Rapid strides are also being made in the introduction of electrical refrigeration into the home, showing how quickly the public accepts this new electric service.

The market for large apparatus for the generation and distribution of electrical current, with the consequent lessening in cost of such current to the public, has shown improvement during the past year. This will probably continue on even broader lines during the coming year. There has been a marked increase in the use of electricity for power in the steel and coal industry, as well as for many other industrial applications. The use of electrical current in drilling oil wells and pumping oil in the oil fields has also greatly increased, but there is still a wide field for future growth. The electrification of railroads has also shown an awakening, which should lead to a very much increased demand for electrical apparatus for this purpose.

There has been a good demand for radio receiving sets during the past year, and while the multiplication of broadcasting stations is becoming embarrassing, it is believed that the activities of the National Broadcasting Co., a company recently organized to provide a means of furnishing the public with better programs, will prove of great benefit, both in reducing the number of stations and in stimulating the public's demand for more and better sets. The radio industry is becoming one of great importance.

Summing up, with the strong and sound financial situation, the scientific development of industry along progressive lines, and the increasing attention to public service in every constructive way, the present period of prosperity should continue at least well into the new year.

*Mr. Herr's statement was received too late to be included in the article "Opinions of Business Leaders," beginning on page 321, and is therefore published separately.

* * *

FORTY-ONE YEARS OF SERVICE

A thousand friends, including many men ranking high in all branches of engineering, industry and commerce, assembled at the Hotel Astor on December 17 at a dinner given in recognition of forty-one years of service to the industries with which he is connected as a publisher, to James H. McGraw, president of the McGraw-Hill Publishing Company, being the occasion of his sixty-sixth birthday.

Mr. McGraw began at the very bottom of the ladder, which he ascended step by step until, by virtue of sheer ability and unceasing work, he reached the very top, being now the head of the largest technical publishing house in the world.

* * *

According to the latest information relating to commercial aviation, there will be, within the next year and a half, from 500 to 600 planes engaged in commercial transportation throughout the United States. In another year, probably 5000 more miles will be added to the 7000 miles of airways now under operation. The Post Office Department has accepted bids for the establishment of fourteen private air lines. An air mail service from Seattle to Los Angeles connects the two cities, 1100 miles apart, in less than a day.

Carburizing in Rotary Machines

In a paper read before the American Gas Association by F. S. O'Neil, works manager of the Link-Belt Co., Indianapolis, Ind., important facts were given concerning the use of rotary retort machines in the heat-treatment of chain. The two plants at Indianapolis make various kinds of chain from many different materials but principally from malleable iron and steel. Casehardening and other heat-treating operations are of considerable importance in chain manufacture. Formerly, all carburizing was done by the pack-hardening method, using muffle type furnaces fired with oil or gas. Some reheating was done in the earlier types of rotary gas furnaces. The cyanide process was used for considerable work of light section. Alloy boxes were used, and the weight ratio averaged about as follows: Box, 50 per cent; work, 35 per cent; compound, 15 per cent.

In considering a more direct and uniform application of heat, investigations led to the rotary type of carburizing furnace, and this abstract of Mr. O'Neil's paper gives some of the results obtained. Although the aggregate tonnage is large, there is a variety of parts, which made batch treatment necessary. As the gas supply came from by-product ovens, the carburizing agent had to be a compound. By installing these rotary carburizing furnaces, revolving retorts have replaced the boxes and, once heated, these retorts are not allowed to cool between charges. The amount of labor has been reduced considerably, as the parts are merely shoveled into the retorts and the carburizing compound is usually handled with a shovel. The retort is heated evenly as it revolves, and the material inside turns over and exposes all sides. The result is a uniform depth of case and a uniform heating throughout the core. In addition, a pressure is developed within the retort by the carburizing gases released from the compound, which hastens penetration. The rotary carburizing machines are arranged in a row on the floor, with the water and oil tank for each furnace set in a continuous concrete pit. The pit has an angle-iron ledge around it, which keeps dirt from getting into the tanks and serves as a track for the moving spout used in discharging the furnaces, as shown in the illustrations. The tanks have a capacity of 850 gallons, which is in excess of the quantity needed. Each tank is equipped with inlet and outlet. The water is kept at the proper temperature by overflow, while the oil is pumped through a cooling system. Each tank also has a quenching basket, properly baffled to the bottom, where it ends in a wire basket form with a hinged door. By opening the hinged door, the material is discharged from the baskets, after raising them from the tanks by an overhead crane, into tote barrels. (See Fig. 2.) The top of the basket is made of diamond top plate with a hinged door cut

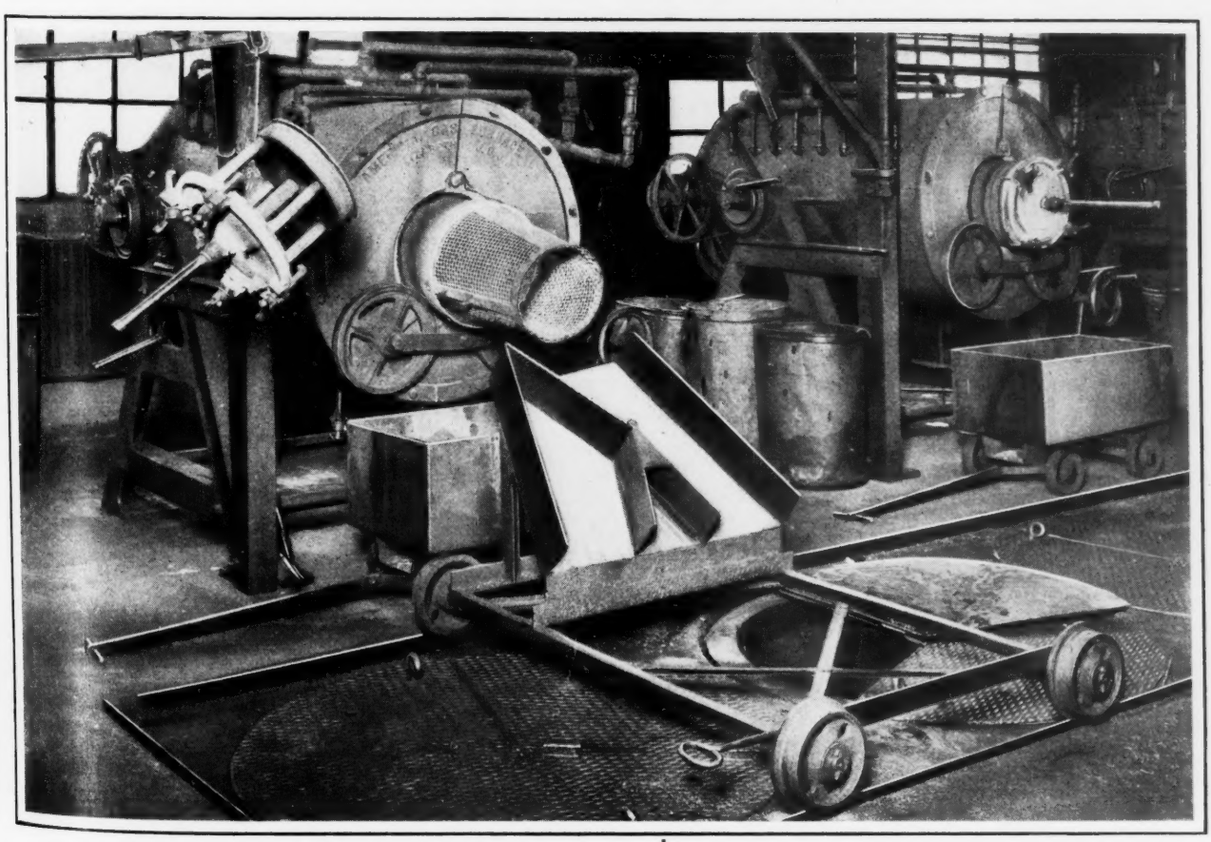


Fig. 1. **The Rotary Retort Carburizing Machine at Left has Screen in Position for Sifting Compound from the Work and Also Double Chute for Discharging Work into Oil or Water Quenching Tank**

in it, and becomes the top of the tank when the basket is in the tank.

In operating the furnaces, the material is shoveled into the retort—approximately 500 pounds per

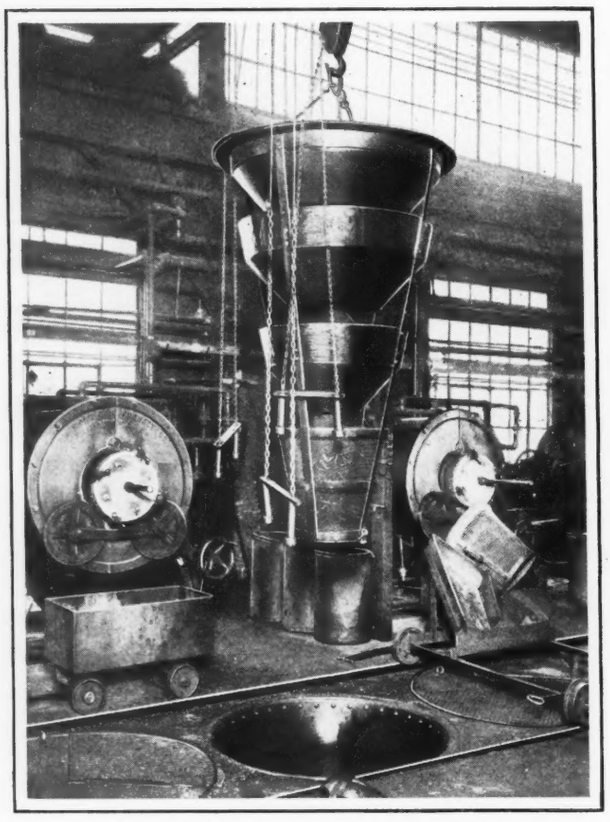


Fig. 2. Close-up View of Baffles and Basket which Fits into the Quenching Tank

charge. The required amount of compound is also placed in the furnace at this time. A small jib crane is placed at the side of each furnace, to handle the retort plug. In discharging the furnace, a conical screen which fits over the end of the retort, as shown in Fig. 1, is used to screen out the compound, and the work flows from this screen into a two-way moving chute, passing it either into the oil or water quench. The hot compound falls from the screen into iron boxes mounted on wheels, which are moved from one furnace to another and out into the yard to cool.

The use of these furnaces is not confined to carburizing alone. They can be used economically for heat-treating and reheating. They also make ideal annealing furnaces, and it is the practice to load them up late on Saturday and anneal over Sunday. The life of the furnace is saved by not letting it cool down, so that the furnaces are nearly up to heat on Monday morning. Throughout the week, the operation of the department is continuous, and a uniform product has been obtained with a considerable saving over previous methods.

All heat-treating is done on a tonnage or pound basis, broken up into three groups; namely, casehardening, heat-treating, and annealing. A flat price is allowed for each, and the total expense of operating the department is set up against the revenue derived from these classes of work. The department either shows a gain, an even break, or a loss, on its factors; and included in these factors are the cleaning operations. Over a period of time, a composite factor is derived, and this becomes a general guide for operations. The expense of the department includes many items: Rental of floor space, light, heat, power maintenance, machine depreciation, cost of retorts, gas compound, fixtures and appliances, labor and supervision, and the general administrative expense.

Using the maximum time necessary on any of the material, the detailed figures per 500-pound charge would be about as follows: Gas, $1.651; compound, $0.295; labor, $1.700; quenching oil, $0.218; machine expense, $1.600; overhead factor, 40 per cent. This would give a cost of $0.01456 per pound for a single treatment. For a reheat and draw, to relieve any gripping strains produced by the case, $0.006 per pound, or a cost of $0.0205 per pound for casehardening.

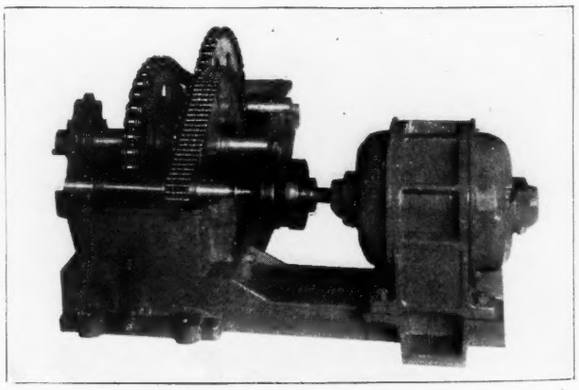
The average gas consumption is around 450 to 475 cubic feet per hour. The gas rate is $1.15 per thousand cubic feet, with a sliding scale for quantity consumption and a discount for prompt payment, which brings the price of gas between 87 cents and 90 cents per thousand cubic feet. The composite factor for all three classes has averaged, over the last six months, $27.50 per ton or less than $0.015 per pound.

* * *

SPEED REDUCER WITH ROLLER CHAINS

In a speed reducer built by the Washington Machinery Depot, Tacoma, Wash., the use of roller chains permits the transmission of power in the same direction as the motor, without employing idlers. A triple-strand chain is used for the main drive, while single-strand chains are employed for the two reduction drives. The entire mechanism is enclosed so that the chains and sprockets may run in oil.

Efficient and silent operation are claimed for the chain drives, because of the automatic absorp-



Roller Chains Used to Transmit Power in a Speed Reducer

tion of wear on sprockets and chains. The chains are made by the Diamond Chain & Mfg. Co., Indianapolis, Ind.

* * *

The United States now has 250,000 miles of main railroad lines and 150,000 miles of additional track. If these lines were laid across the country from the Atlantic to the Pacific, 130 transcontinental lines would be provided. This gives an idea of the enormous mileage of our railroads.

RECLAIMING CAR AXLES IN FORGING MACHINES

In many railroad shops, the practice followed in reclaiming worn car axles requires the use of several machines and a number of operations as follows: First, the integral end collars are removed, either by turning them off in a lathe or drawing them down under a steam hammer. Then the axle is lengthened between the journals, so that the worn fillets of the wheel seats can be corrected. This lengthening is accomplished by drawing out the wheel seats under a power hammer, or by swaging them in a bulldozer or upsetting forging machine. Next new end collars are formed, and the over-all length is shortened. This operation is also performed in either a bulldozer or an upsetting forging machine. At the end of these operations it is the practice to anneal the axles to remove all service or forging strains and then to turn the axle ends to the next smaller size.

The reclamation of car axles up to the annealing process can now be accomplished in a single machine built by the Ajax Mfg. Co., Cleveland, Ohio. The machine is a new model 6-inch twin-geared upsetting forging machine, provided with increased power for the die mechanism, and accommodating dies large enough for 6- by 11-inch axles. Dies with three grooves, a punch, and a heading tool, all of which are shown in Fig. 1, comprise the necessary tools.

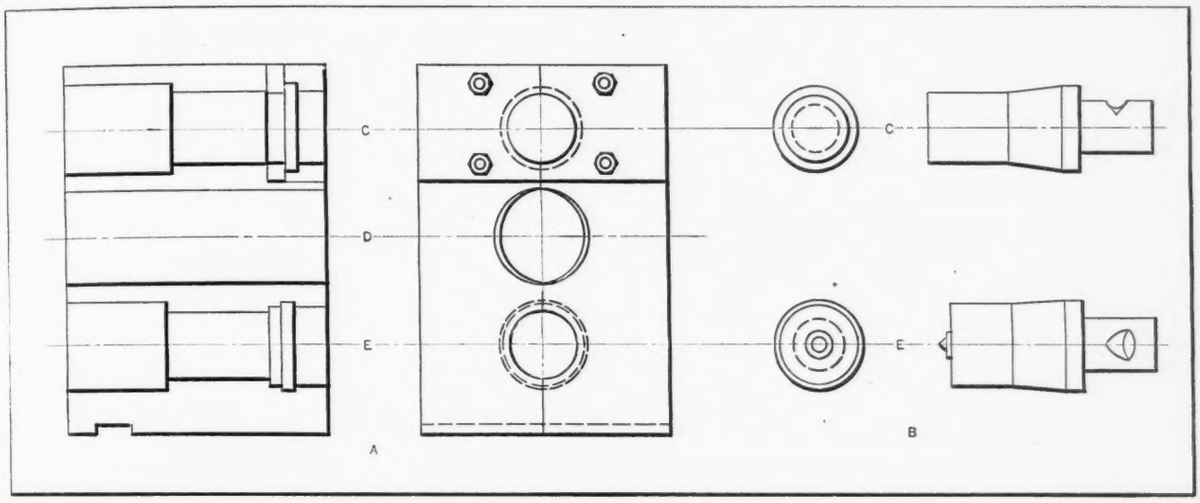


Fig. 1. Dies, Punch, and Heading Tool Used in Reclaiming Axles in an Upsetting Forging Machine

After one or both ends of an axle have been heated well past the wheel seats, one end is placed in groove *C* of the dies shown at *A*, and the machine is operated to punch off the end collar, as indicated at *B*, Fig. 2. At *A* in Fig. 2 is shown a

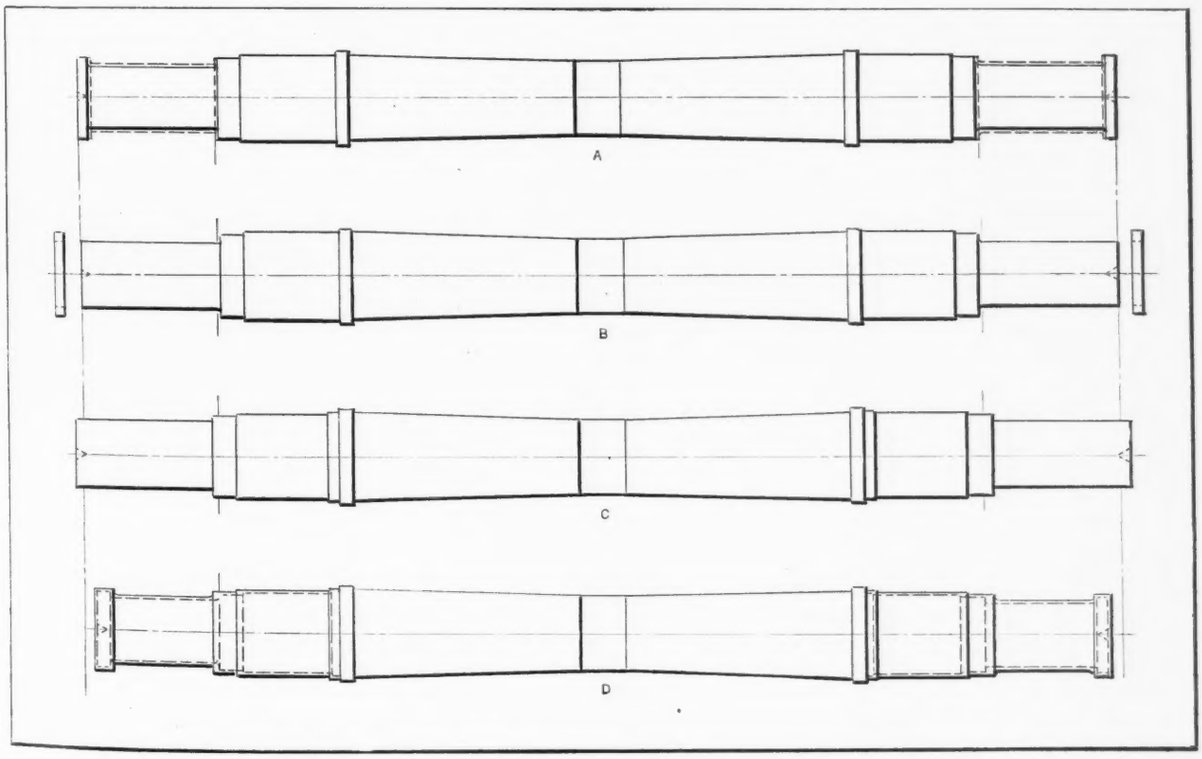


Fig. 2. Various Stages in the Reclamation of a Scrapped Car Axle

worn car axle with the original outline of the wheel seats indicated by dotted lines.

When the first step of the reclaiming operation has been performed, the axle is transferred to groove *D*, Fig. 1, of the dies, and the machine is operated twice to reduce the wheel seat about 1/4 inch in diameter, the axle being revolved 90 degrees between the two squeezes. This operation reduces the wheel seat to a definite diameter, so as to facilitate gripping the axle in the next step. The axle is also lengthened sufficiently to permit finishing the worn inside journal fillet. At the end of this step, the axle appears as illustrated at *C*, Fig. 2.

The final step of the operation consists of placing the axle end in groove *E*, Fig. 1, of the dies, and then operating the machine to form a new end collar and to upset the axle to the desired length. The heading tool also centers the end, ready for the subsequent turning operation. Instead of using a back-stop in the final forging step, as in the past, to hold the axle against the pressure of the heading tool, the wheel seat is firmly gripped by the dies. A cavity in the dies at the point where the collar is formed allows for excess metal on axles that have been worn but slightly.

Some shops heat and forge one end at a time, whereas others prefer to reforge both ends with one handling. At the end of the forging operation, the axle has the outline indicated by the solid lines at *D*, Fig. 2, and is ready to have the ends turned to the dotted outline. Time studies made in trial demonstrations indicate that a steady production of from fifty to sixty axle ends, or twenty-five to thirty axles, can be maintained per hour in this operation.

* * *

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

London, December 20

At last it is possible to report that the British metal-working industries are free from the paralyzing effects of the six and a half months coal stoppage. It is to be hoped that the industry will, by providing good mining equipment and by sane, straightforward business dealings between owner and miner, place itself on a more sound and stable basis than it has ever been.

Although the stoppage has not had so bad an effect on the machine tool industry as was once feared, it has caused great losses to the engineering field generally. Some branches—like shipbuilding and steel works—have been almost at a standstill for months, but it is reassuring to note that orders have been steadily accumulating during that period, with the result that they now find themselves on the eve of a boom. Optimistic prospects have been tempered by the thought that high prices would have to be paid for coal for some time after the settlement, but stocks are already accumulating rapidly at the pit heads. There is no doubt that judicious buying on the part of manufacturers, and the strict economy that the public are resolved to practice, is holding prices down considerably.

Reports from all parts of the country are unanimous in their optimism for the future. Signs are not wanting that this country will slowly recapture her industrial position. Large shipbuilding orders are constantly being placed, and textile machinery makers report improving business, one firm alone having recently received an order for cotton mill machinery valued at £1,000,000, for a large mill at Melbourne. The contract for the Buenos Aires underground railway valued at £10,000,000 has also been awarded to this country, and will do much to help rolling stock manufacturers and steel makers. The order for the £1,200,000 floating dock at Singapore has been officially placed and will provide employment at the yards concerned for nearly two years. Although the home railways have naturally refrained from launching any new projects or placing many orders, a large volume of business has been received from overseas for locomotives and cars. Electrical construction engineers are all doing splendidly, and are busier than they have ever been.

It is rather surprising that the machine tool builders have been able to keep their men well employed. A few have had recourse to short time, but the majority have kept going well, and in some instances over-time has been reported. No big orders have been placed during the month, but the industry is generally congratulating itself on having emerged from the depression with ease. The automobile industry has done much to keep machine tool builders going, especially as, without exception, automobile makers have booked, from the annual show, not only splendid home business but, what is more important, a vastly increased export business. They have at last realized the urgency of making determined efforts to get a firm footing in the Colonies and other overseas countries, and it is to be hoped that their efforts will be rewarded.

The automobile industry has, of recent years, been the mainstay of machine tool makers, and it is interesting to note the result of the use of cost-reducing machines. Materials cost from 30 to 50 per cent more than at the beginning of the war, wages are 85 to 95 per cent higher, yet a greatly improved car is now produced at a considerably lower cost, probably in the case of large-output factories as much as 50 per cent lower. Last year the automobile production of the country was 154,000 cars, of which about 40 per cent came from the Morris organization. The employment figure was 250,000, and the wages paid £40,000,000.

A feature of the machine tool industry is the large number of special machines that are being designed for railway, automobile, and constructional work. Since 1923, the machine tool industry has gradually increased its share of the British overseas machinery business, the tonnage proportion being 2.6 per cent in 1924, 2.8 per cent in 1925, and 2.9 per cent up to the end of October this year. The values have increased in roughly the same ratio, namely, 3 per cent, 3.4 per cent, and 3.5 per cent. This is gratifying, as it shows that the industry has not had to make price sacrifices in order to obtain foreign business.

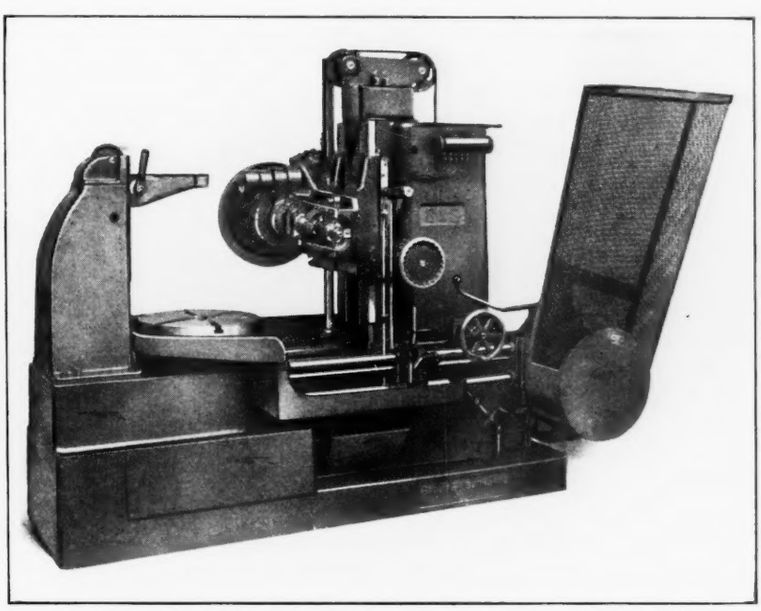
As regards the machine tool exports for October, the last month for which figures are available, there was an increase of 400 tons over the September figures, or a total of 1212 tons. The value rose some £44,000, to £138,671. The import figures were 852 tons, valued at £83,725.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

GOULD & EBERHARDT MANUFACTURING HOBBING MACHINE

Steel spur gears up to 36 inches in diameter and having teeth as large as 3 diametral pitch can be cut on a production basis in a manufacturing hobbing machine recently developed by Gould & Eberhardt, Newark, (Irvington), N. J. Gears up to 42 inches in diameter can be cut without using the support. Except for size, this No. 36-HS machine is similar to the No. 16-HS hobber described in February, 1924, MACHINERY. It is especially adapted to cutting transmission gears for trucks and tractors, other gears of medium sizes, sprockets, spline shafts, etc. Worm-wheels can also be hobbed by equipping the machine with an automatic infeed attachment.



Gould & Eberhardt Manufacturing Hobbing Machine

Among the features of the machine is the worm and worm-wheel drive to the cutter-spindle. The cutter-spindle can be swiveled from 0 to 15 degrees to accommodate single-, double- or triple-thread hobs for both roughing and finishing operations. Exactly the same number of gears are used to transmit power to the cutter-spindle as to the work-spindle, and thus, uniformity of rotation between the cutter and the gear blanks is assured.

The feeds and speeds are comparable with those employed in hobbing smaller gears. The cutter carriage is arranged with a power traverse of 100 inches per minute in either direction, and this rapid traverse may be used with the work- and cutter-spindles rotating or idle. The rapid-traverse operating lever is interlocked with the feed-lever, so that the feeding and traversing movements cannot be actuated at the same time. Also, the rapid traverse downward cannot be accidentally engaged.

The hob is automatically stopped in the cutting position by means of an adjustable cam. After the hob has been stopped, the feed may be started by tripping the feed-lever. The cutting cycle is completed as the rapid power traverse returns the cutter carriage to the upper position for reloading the work. Gears up to 24 inches in diameter can be accommodated by the work-arbor support.

The drive is through a constant-speed pulley, equipped with a plate clutch and running on Timken roller bearings. It is entirely enclosed by an expanded metal guard. All driving parts of the machine have been segregated in a case mounted on the rear of the base. A positive-driven pump supplies lubricant copiously to all the principal parts of the mechanism. In addition, the index change-gears and cutter speed gears are enclosed in compartments in which streams of oil constantly flow. A centrifugal pump supplies coolant to the cutter. The coolant is conveyed through the cutter carriage and flooded on the hob without splashing.

Both the work-spindle and cutter-spindle are provided with taper bearings, which may be adjusted without dismantling. There are separate adjustments for the taper fit and the end fit, and either adjustment can be made independently of the other. To facilitate using the full length of the hob, a positioning device is provided which makes it possible to shift the hob from a dull to a sharp position without taking the hob from the arbor and inserting spacing collars.

When it is desired to drive the machine with a motor, a bracket for the motor may be mounted over the gear-case at the rear. The drive from the motor to the machine is then accomplished through a silent chain. A 7 1/2-horsepower motor running at a speed of about 1200 revolutions per minute is recommended. This machine weighs about 9000 pounds.

BETHEL-PLAYER LAPPING MACHINES

Two new machines have been added to the line of lapping equipment built by the Bethel-Player Co., Westboro, Mass. One of these machines is intended for use on cylindrical and flat parts in shops where the production does not warrant one of the larger machines built by this concern. The other machine is designed for simultaneously lapping three parallel cylindrical holes in parts.

The first mentioned of these machines—the No. U-1 illustrated in Fig. 1—comprises upper and lower laps which revolve in horizontal planes. The lower lap is carried by a rotating head which is supported on the upper end of a vertical hollow shaft. This shaft turns around a fixed shaft or column. The hollow shaft, with the head and lap, is driven by a worm at its lower end.

The head also carries an internal gear which meshes with two pinions. On the upper face of each pinion there is an eccentrically adjustable driving pin, the center-to-center distance of these pins corresponding with holes on a radial line on the work-holder. The work-holder, with the work to be lapped, is located on the head with the holes engaging the driving pins and with the work resting on the lap. According to the eccentricity of the pins, both an eccentric and a rotary motion are imparted to the work-holder in an operation, while the lap rotates in the same direction.

The upper floating and non-rotating lap is carried by a spindle in an arm which may be swung on the column at the rear of the machine. This arm may be raised or lowered by means of the toggle hand-lever. The upper lap presses on the work by gravity. It may be replaced with suitable fixtures for presenting angular surfaces of the work to the bottom lap. Power is transmitted to the machine through a friction clutch controlled by means of the lever seen at the front of the machine. This machine occupies a floor space of 36 by 26 inches when equipped with a one-horsepower motor.

The No. 1-H machine, illustrated in Fig. 2, may be employed for lapping cylindrical holes from 1/2 to 2 inches in diameter and from 3/8 to 1 inch in depth in such parts as tappet rolls. It is equipped with three spindles, which are driven through a silent chain and bevel and Fabroil gears, all of which reciprocate together. They are reciprocated by means of a lever which can be made to give four different lengths of stroke. Movement is imparted to the lever through a link, by a heart-shaped cam. This cam is gear driven from the spindle drive shaft, and the number of strokes per revolution of the spindle can be easily changed to suit the work.

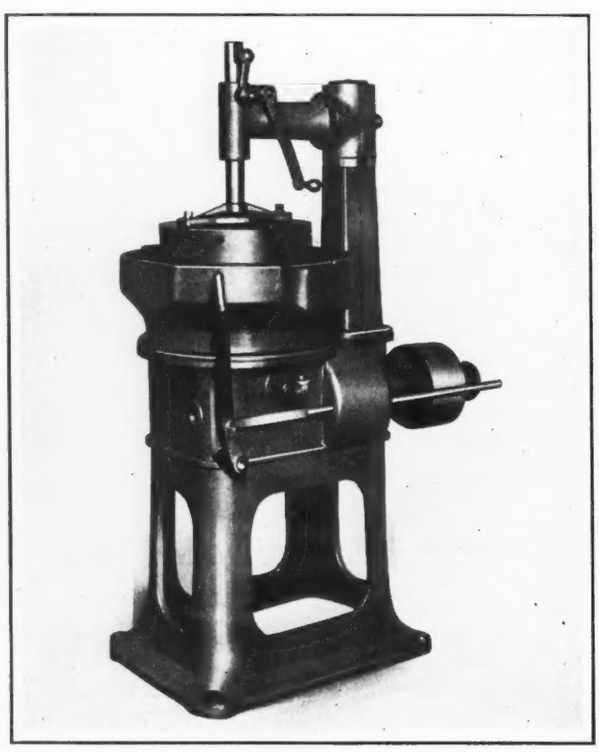


Fig. 1. Bethel-Player Lapping Machine for Flat and Cylindrical Parts

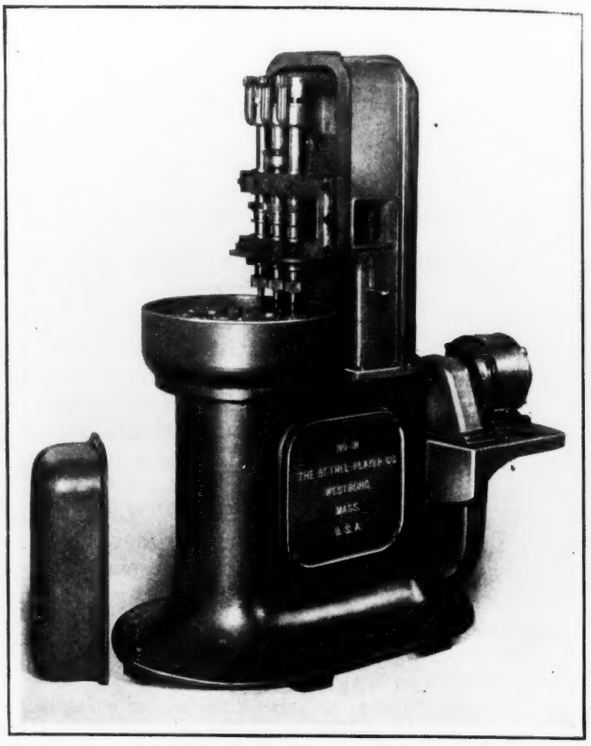


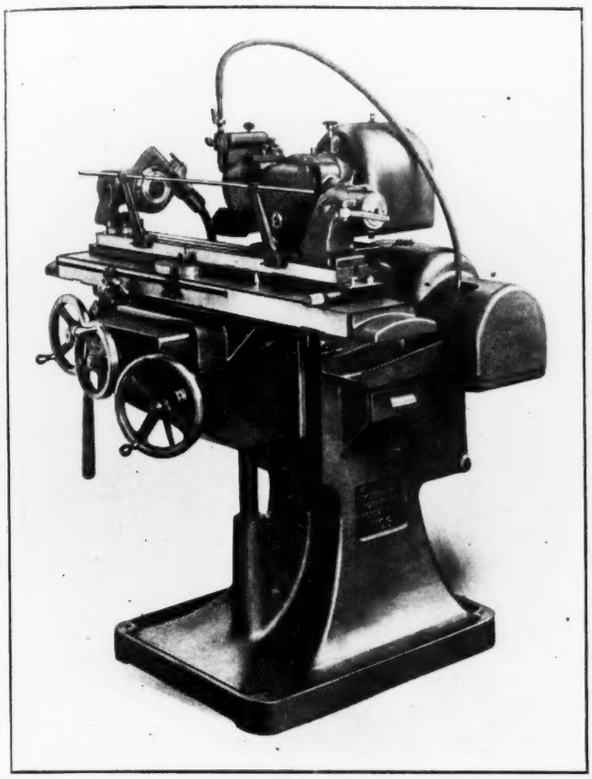
Fig. 2. Machine Designed for Simultaneously Lapping Three Holes

The three spindles are hollow and contain rods with conical points. At the right time in the cycle of an operation, these rods are lowered to expand adjustable collapsible laps attached to the spindles. The lapping process then commences, and at the end of a predetermined period, the lap spindles again are raised, and the work-table descends and indexes. The table then is raised into the working position, the spindles lowered, and the operation performed as before.

The work is supported in full-floating holders, which are mounted in rows of three on a four-station circular table. While one set of three pieces is being lapped, there is ample time for reloading the pieces of the other sets. The machine is fully enclosed and self-lubricating. It can be motor-driven, weighs approximately 2800 pounds, and occupies a floor space of 5 by 3 feet. With this machine, 150 pieces 1/2 inch in diameter by 1/2 inch long, have been lapped per hour.

OESTERLEIN TOOL-ROOM GRINDER

The No. 3 universal tool-room grinder recently brought out by the Oesterlein Machine Co., Cincinnati, Ohio, is entirely self-contained, the machine being driven by direct-connected motors without the use of belts. The one-horsepower motor used to drive the wheel-head delivers power to the spindle through a flexible coupling, intermediate gears, and spiral gears. Two wheel speeds are provided by the intermediate gears. The wheel-



Oesterlein Motor-driven Universal Tool-room Grinder

head motor is mounted on the column, and the entire unit can be swiveled 90 degrees either way.

An automatic table feed and water supply system are provided. The source of power for the pump, table feed, and work-head is an enclosed motor mounted at the rear of the machine. Three work-head speeds are furnished, and there are three rates of automatic table feed. The pump is driven direct by gearing from one end of the armature shaft.

In addition to the automatic table feed, there are three means of hand table reciprocation. High- and low-ratio feeds are obtainable by means of a handwheel, while a quick short-stroke reciprocation may be effected through a lever.

SCHUCHARDT & SCHUTTE GEAR-HOBBING MACHINE

An improved type of Schuchardt & Schutte hobbing machine for spur and helical gears has recently been placed on the market by the George Scherr Co., 142 Liberty St., New York City. Worm-wheels can also be hobbed on this machine by the use of a special tangential-feed cutter-head and a tapered hob. This machine has been increased in weight more than 20 per cent with a view to meeting the demands of quantity production with high-power tools. The driving heads and shafts have been made larger to eliminate torsion.

The cutter-spindle is driven by means of helical gears instead of spur gears as formerly. It is of three-bearing construction and, as shown clearly in Fig. 2, has a flywheel mounted directly on it, which need not be removed for any class of work. These improvements in the cutter-spindle result in smoother running of the cutter and improved finish of the work. The cutter-head overhangs but little from the upright, and any play can be taken up through adjustable taper gibs. The cutter-head casting has a semicircular depression in which the hob revolves. The bearings, which are located close to the hob, are tapered and are adjustable for wear.

The ways of the bed are flat and wide, and the the carriage is supported close to the spindle. The table bearings consist of V-shaped ways, a flat bearing, and a cylindrical bearing. This construction eliminates vibration or sagging of the table under heavy cuts and loads. To permit pinions with a shaft to be cut, the table has a large bore and the carriage feed-screw is located at one side so as not to obstruct the bore. The dividing worm-gear is directly under the table, and is of practically the same diameter. The worm is hardened and ground, and bears against hardened steel washers.

All control levers are located within convenient reach from the normal position of the operator, and all speed and feed changes are obtained through gear-boxes. These features afford easy operation of the machine. The differential and feed gear-box in front of the column provides nine different feeds which can be obtained while the machine is running. Thus, feeds can be increased or decreased during an operation as required for obtaining the best production and finish. It is unnecessary to exchange gears for cutting either right- or left-hand helical gears.

Automatic stops are provided for the vertical feed to the cutter-head and the horizontal feed to the table. Power rapid traverse is provided for both the cutter-head and the table. There is also a hand adjustment for the cutter-head by means of a handwheel on top of the feed gear-box, and for the table by means of a crank at one end of the bed. The quick return of the cutter-head is obtained independently of the feed mechanism and hence, when helical gears are being produced with

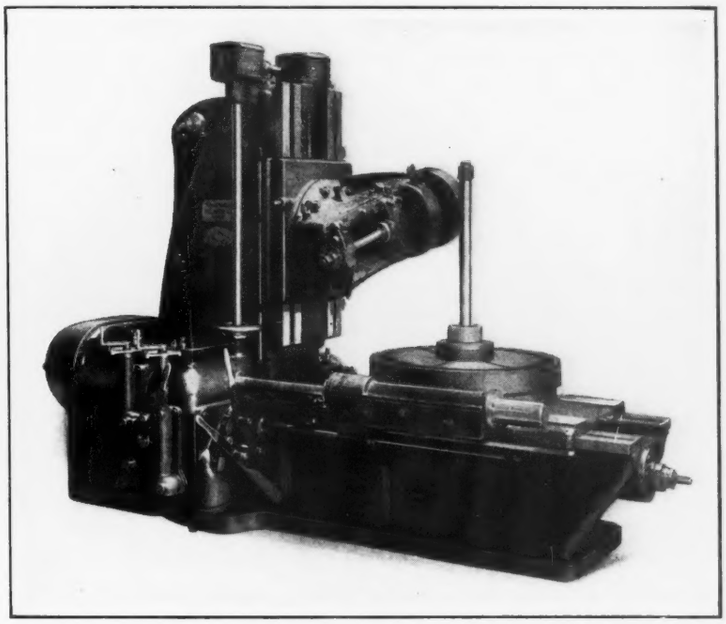


Fig. 1. Schuchardt & Schutte Improved Gear-hobbing Machine

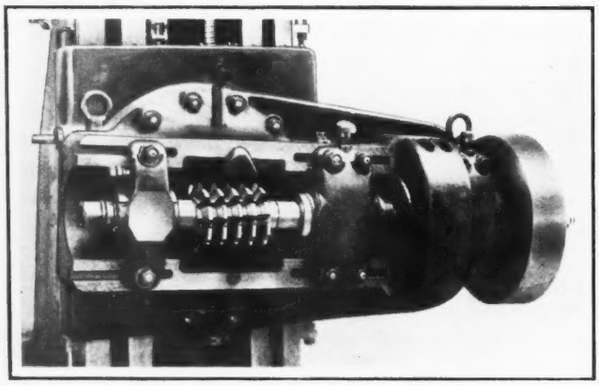


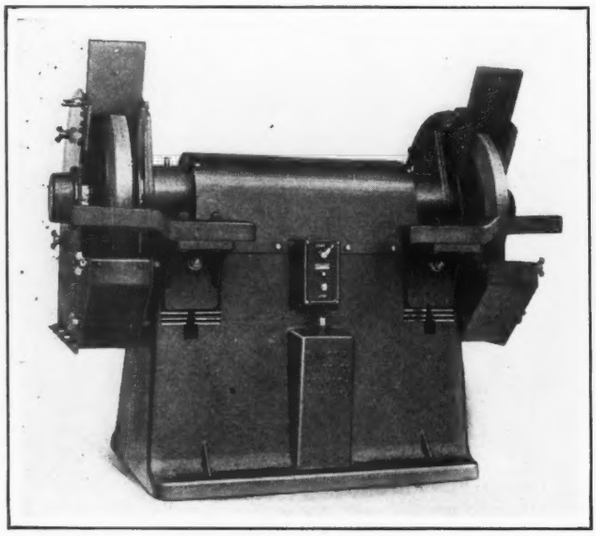
Fig. 2. Close-up View of the Cutter-head

two cuts, the rapid return may be used without losing the spiral lead.

The machine is driven either by a single pulley or an individual motor, power being delivered, in both cases, to a quick-change gear-box at the rear of the column. This gear-box furnishes eight different cutter speeds. To obtain constant power and eliminate vibration, flywheels are placed on the main horizontal and vertical driving shafts on the inside of the machine. A pump furnishes abundant coolant, while index, feed, and differential gears are automatically oiled. As a protection against chips, the table feed-screw is housed in telescoping tubes and the column has sliding guards below the cutter-head. The cutter-head used for producing worm-wheels can also be used for cutting spur gears and helical gears having an angle not greater than 15 degrees.

RANSOM GRINDING MACHINES

Grinding machines with motor-in-base drives are being placed on the market by the Ransom Mfg. Co., Oshkosh, Wis. These machines are known as the RW type, and are built in several sizes. Any desired speed of the grinding spindle can be obtained, and any make of motor operating on alternate or direct current can be used. The motor is fastened to a hinged platform in the base. This platform can be raised or lowered by revolving the vertical screw seen at the front of the machine. In this manner, the belt tension can be conveniently regulated.

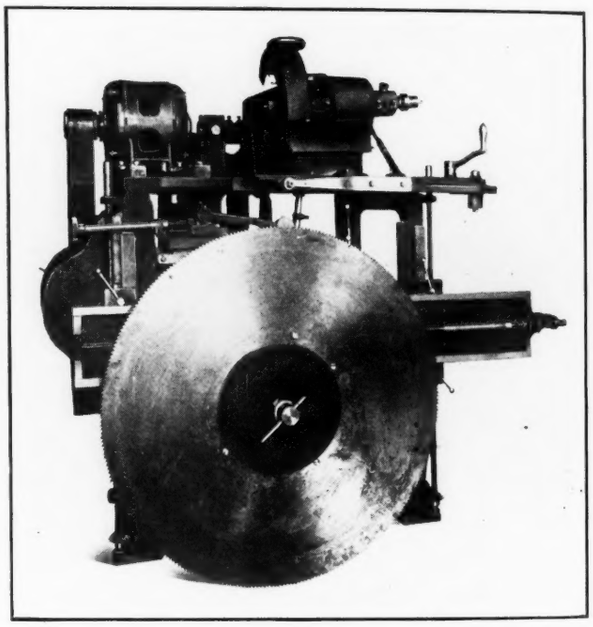


Ransom Grinding Machine with Motor-in-base Drive

The rest brackets are removable to permit the grinding of large castings held on the knees of operators. These brackets are adjustable up and down to suit different sized castings. Fabricated steel wheel guards are provided. The spindle revolves in S K F ball bearings. These machines can be built to run at speeds of from 9000 to 10,000 feet per minute to suit rubber-bond wheels.

AUTOMATIC SAW GRINDER

Hot and cold metal-cutting saws from 36 to 84 inches in diameter can be automatically ground in a machine being placed on the market by the Machinery Co. of America, Big Rapids, Mich. The feeding and grinding movements of this No. 146 automatic grinder are controlled by two cams, one



Automatic Grinder for Hot and Cold Metal-cutting Saws

of which operates the feed-arm for properly feeding and spacing the saw tooth by tooth. The other cam operates a lift arm which controls the action of the grinding head and brings the grinding wheel into contact with each tooth as the tooth is fed into the grinding position. By varying the size, shape, and timing of these cams, and making adjustments of the feeding and grinding mechanisms, practically any shape of tooth can be produced. The cross-bar which carries the saw is 10 inches wide by 6 feet long, and is raised and lowered by power to the proper height to handle the heaviest saws. An adjustable cone on a 2 1/2-inch cross-head pin holds the saws in place.

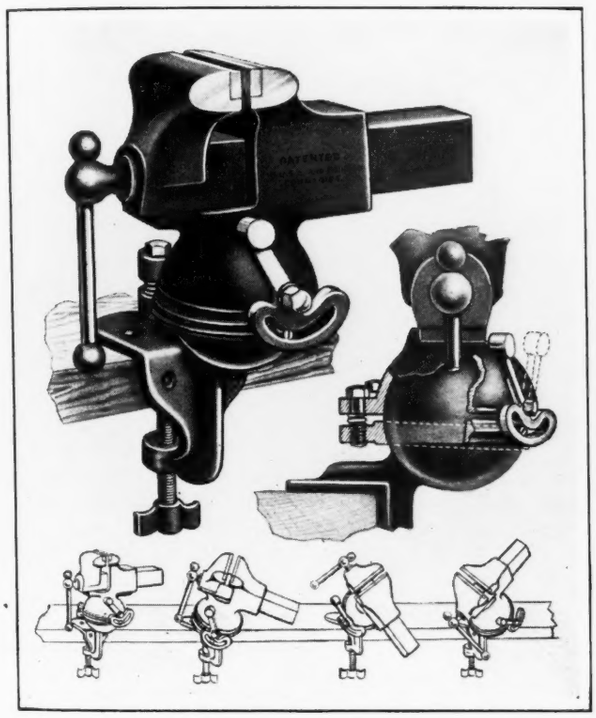
It is mentioned that with this machine, a saw blade with badly worn or broken teeth, or even a blank plate with no teeth, can be made into a saw with all teeth uniform and of the proper size and shape. The machine can also be equipped for feeding direct from the saw teeth instead of from an index-plate. This method is feasible, however, only when the saw teeth are not allowed to become much worn or damaged before resharpening. Two mo-

tors are employed, a five-horsepower motor for driving the machine, and a one-horsepower motor for raising and lowering the saw.

MC CARTER UNIVERSAL VISE

A ball-and-socket arrangement in the McCarter universal vise now being introduced to the trade by the Bel-Kel Mfg. Co., 740 E. North St., Decatur, Ill., makes it possible to shift and lock the vise in any desired position. The construction of the vise, as well as typical positions in which it can be locked, are shown in the illustration. After the vise has been positioned by a mere twist of the wrist, a lever is tightened to lock it in place.

The vise is particularly useful in tool-rooms, welding and repair shops, etc. It is made in four



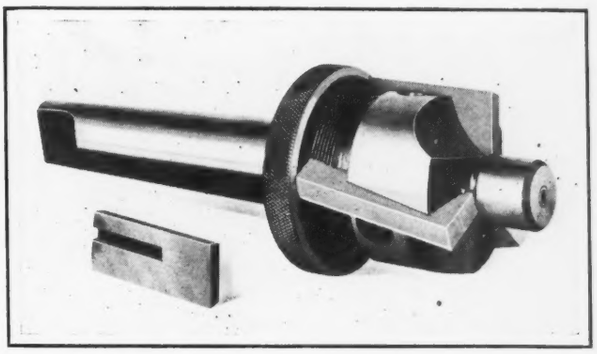
Construction and Typical Settings of the McCarter Universal Vise

sizes, having jaw widths of 2, 3 1/2, 4 1/2 and 6 inches, respectively. The maximum jaw openings of these sizes range from 2 to 9 inches, and the weight of the vises, from 8 to 60 pounds.

GENESEE FACING TOOL

Spot-facing, grooving, forming, and similar operations can be conveniently performed by means of an improved facing tool being placed on the market by the Genesee Mfg. Co., Inc., Rochester, N. Y. The blades of this tool are held in a hardened, chrome-nickel steel body, provided with interchangeable pilots. One of the features of the tool is that the blades can be removed for regrinding without taking the holder from the machine.

The blades are held in place by means of bushings located in holes that are offset relative to the blades. These bushings are tightened by means of fillister-head screws, the heads of which are beneath the surface of the body. The pilot hole in the body is ground so as to permit the use of



Genesee Tool for Spot-facing, Forming and Similar Operations

ground pilot shanks. Because of the manner in which the pilot is held, there is no pressure of the pilot against the cutting edges of the blades, which would tend to break the blades.

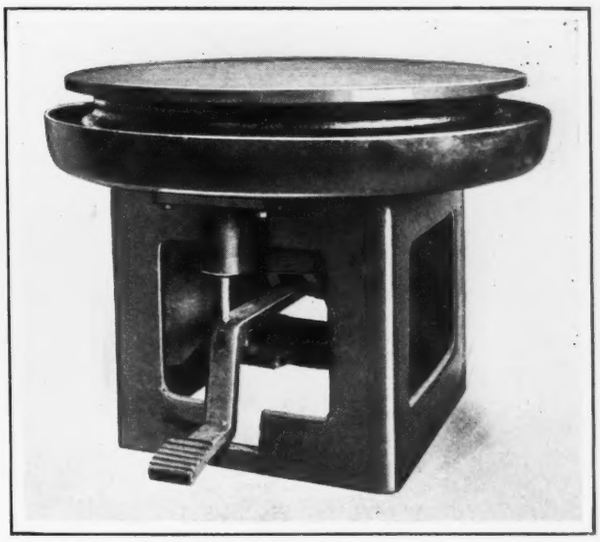
Drills, reamers, etc., can be employed in place of the pilot. This facing tool is made in many standard sizes, from 1 1/4 to 4 inches in diameter, and special sizes can be furnished to order.

HOEFER INDEXING TABLE

Many applications can be made of an indexing table recently placed on the market by the Hoefer Mfg. Co., Freeport, Ill. This table may be bolted to the base of a drilling machine, for instance, and provided with jigs to permit parts to be drilled in one jig while parts in other jigs are being counterbored, hollow-milled, tapped, spot-faced, reamed, reloaded, etc. By the use of this table, many single-spindle machines can be converted into highly productive multiple machines.

The sub-base contains a foot-operated locking plunger, one end of which is taper-ground and enters hardened and ground bushings. The number of bushings depends on the number of stations.

The table is carried by a large central stud and is held down by means of a collar on the lower end of the stud. This construction permits wear to be compensated for. The table rests on roller bearings, and can be turned with little effort.



Hoefer Indexing Table Designed for Use with Drilling Machines

HANNA RIVETERS

Two new riveters are being introduced to the trade by the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. Fig. 1 shows a portable compression yoke riveter, and Fig. 2, an alligator-type riveter designed primarily for use in constructing steel barges. The first mentioned machine has a reach of 24 inches, a gap of 15 inches, and weighs about 1500 pounds. It is capable of exerting a pressure of 50 tons on the rivet die with an air pressure of 100 pounds per square inch.

With the riveter suspended as shown, rivets are inserted from above and headed from below. Rivets may be placed far in advance of the riveter, enabling the "rivet-sticker" to devote a portion of his time to drift pins and stitching bolts, without interrupting continuous riveting. The machine may also be suspended with the dies vertical and the cylinder up, or with the dies horizontal and the cylinder up. The distance from the inside top surface of the live stake to the bottom of the rear cylinder head is only 29 inches. This permits of using the riveter on girders laid down, where the height is usually influenced by the reaming.

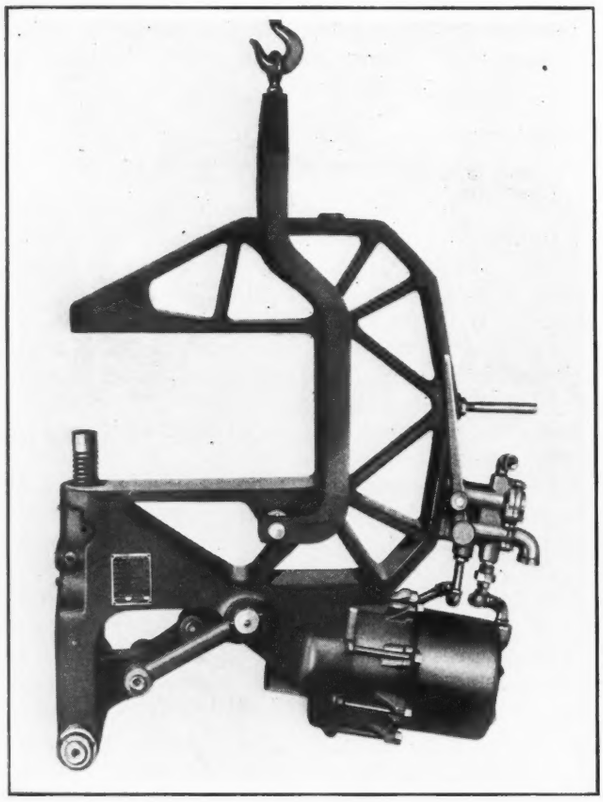


Fig. 1. Hanna Portable Compression Yoke Riveter

The air is controlled through a Hanna combination operating valve, which is a distinct unit mounted in any convenient location for operation by hand or foot. The pressure-exerting mechanism combines a long die stroke with a wide range of uniform pressure. The first part of the die stroke is rapid, as the upper die approaches the work, after which the die or plunger speed gradually decreases until it enters the uniform pressure area of the stroke. Ordinary variations in rivet lengths and plate thicknesses are automatically taken care of.

When the alligator-type riveter is operated with an air pressure of 100 pounds per square inch, a pressure of 50 tons is also developed on the dies, which is sufficient to drive 7/8-inch rivets watertight. The dies of this equipment are positioned horizontally, and the cylinder is arranged vertically above the dies.

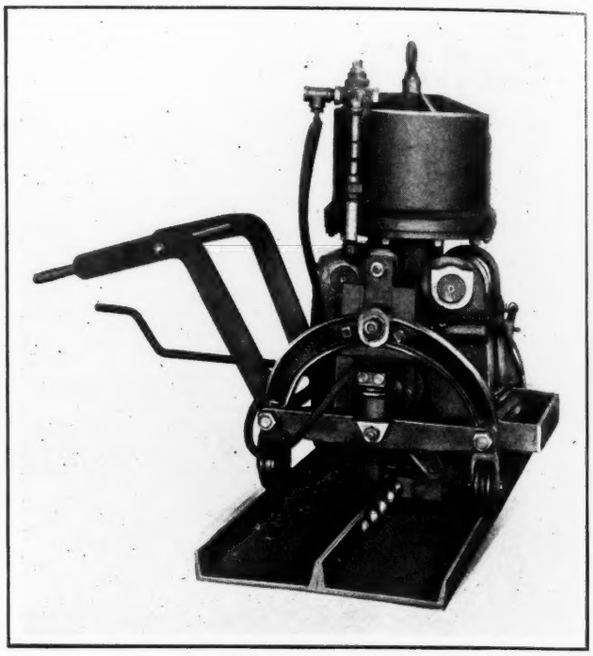
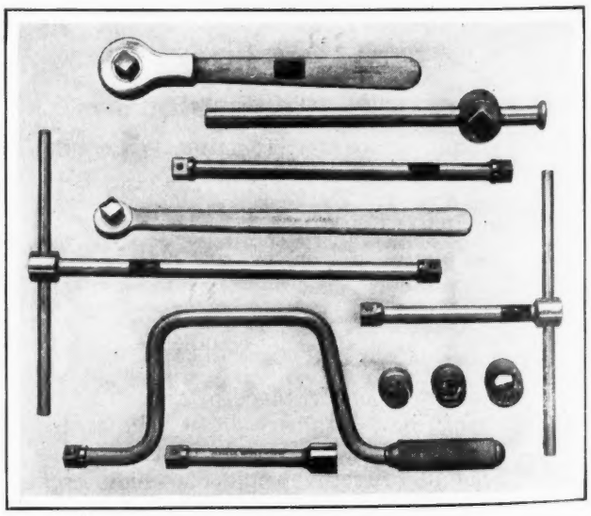


Fig. 2. Hanna Alligator-type Riveter with Horizontal Dies

The machine is mounted on a cradle carriage, designed to run on the flanges of the channel- or angle-irons being riveted. The cradle is provided with a mechanism whereby the immovable die can be nudged on and off the manufactured head of the rivet. Adjustments permit of setting the wheels of the cradle carriage to various gage widths to suit the size of the channel-irons being riveted. The entire machine is moved from rivet to rivet by revolving a handwheel. This machine also weighs approximately 1500 pounds.

BONNEY DETACHABLE-HEAD SOCKET WRENCHES

A complete line of detachable-head socket wrenches made of chrome-vanadium steel has been brought out by the Bonney Forge & Tool Works,



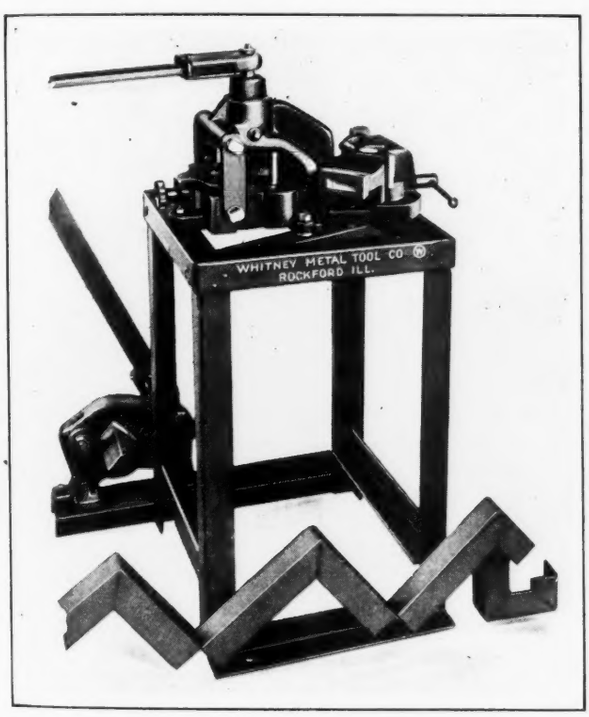
Bonney Detachable-head Socket Wrenches

Allentown, Pa. The sockets are forged from solid bar stock in a manner that is said to retain the fibers of the steel unbroken. It is claimed that bolts will be broken off and threads stripped before one of these wrenches is damaged. The wrenches are made with thin walls to permit them to be used in close quarters.

There is a large assortment of handles for use with the sockets. The handles are also forged from chrome-vanadium steel, and comprise solid offset handles, ratchet offset handles with reversible lugs, T-handles, sliding T-handles, and ball-bearing brace-type handles. Extension bars can be used with any of the handles for reaching otherwise inaccessible places.

WHITNEY COMBINATION BENDER

Angle-irons can be notched and bent in either direction in the No. 455 combination machine recently brought out by the Whitney Metal Tool Co., Rockford, Ill. Examples of typical work performed



Whitney Angle-iron Notcher and Bender

on this machine are shown at the foot of the machine in the accompanying illustration. Legs of 2- by 2- by 1/4-inch angle-iron can be quickly notched, and the angle-irons then bent to the required form. The operating handle is made of malleable iron with a view to eliminating breakage of this part.

GARDNER VERTICAL-SPINDLE DISK GRINDER

A vertical-spindle disk grinder, equipped with a disk wheel 18 inches in diameter by 5/8 inch thick, has been added to the line of grinding machines built by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. The disk wheel is supported by a collar mounted on the rotor shaft which acts as the driving spindle of the machine. The motor frame itself serves as the machine base.

Gardner Small-size Vertical-spindle Disk Grinder

In the standard type of machine, the distance from the floor to the grinding member is about 22 1/2 inches, this height permitting the operator to sit while at work. However, a pedestal is provided to raise the grinder when it is desirable for the operator to stand. A push-button station for controlling the machine is mounted in any convenient position on the base.

Work-holders, a dressing device, etc., may be secured to a cast-iron guard ring fastened to the top of the base. The dressing device is of the horizontal bar type, in which a sliding block that carries the dresser cutters is forced back and forth across the abrasive disk by hand. Although this No. 88 machine is not equipped with a water tank, wet grinding can be performed. The machine occupies a circular floor space 25 inches in diameter. For maximum duty, 5 horsepower is required.

TUTHILL LUBRICATOR PUMPS

A line of improved gear pumps designed especially for machine tool applications has recently been placed on the market by the Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill. The pumps are

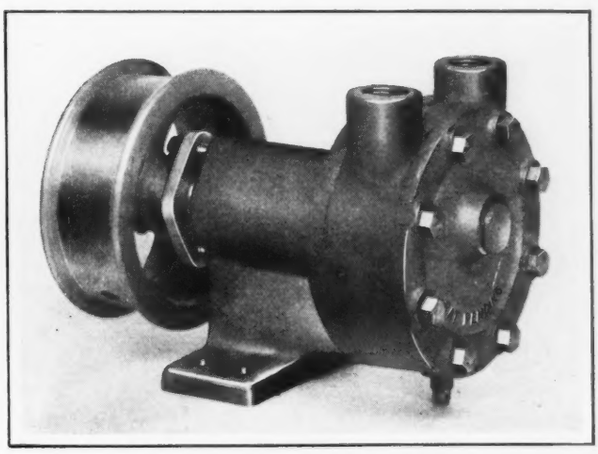


Fig. 1. Tuthill Pump Designed Primarily for Machine Tools

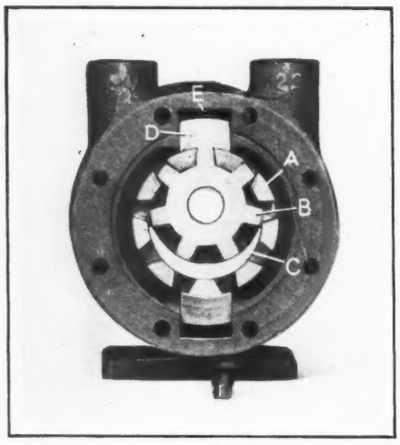


Fig. 2. Internal Construction of Pump

manufactured in plain and reversible types of four sizes each, which provide for delivering from 2/3 to 18 gallons of liquid per minute. All parts are made in jigs and are interchangeable.

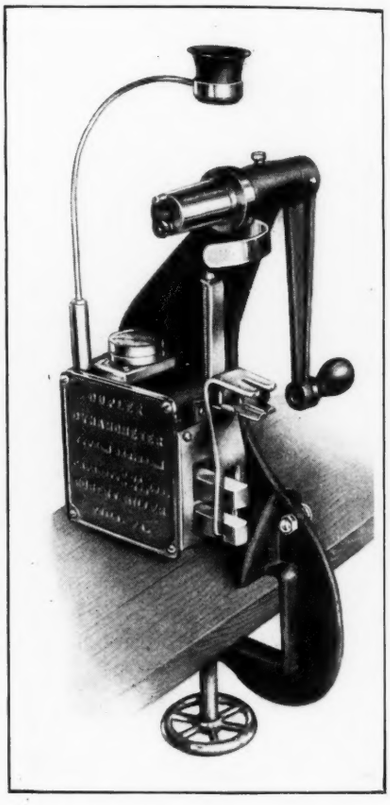
Each pump consists mainly of a housing in which rotate an internal or driving gear *A* and an idler or driven gear *B*. The latter, together with the crescent member *C*, is mounted on the cover in such a manner that when the pump is assembled, the space within internal gear *A* is completely filled. Pumping action is produced as the teeth of the two gears disengage on one side and draw in the liquid. The liquid is carried past the crescent member to the other side of the pump, where it is forced out as the gear teeth are engaged. The pumping action is continuous and results in a steady non-pulsating stream of liquid.

The space between the intake and discharge sides is sealed by the hardened steel land *D*, which is held in place by a light spring *E*. This land is subjected to the oil pressures above and below it, and adjusts itself up and down to maintain the amount of flow allowed at the discharge. When the full amount is being pumped, the land is down close to gear *A*, but when the liquid is shut off at the discharge, the pressure causes the land to rise and allow the liquid within the pump to by-pass. This construction simplifies installations and lengthens the life of the pump, as small chips and grit readily pass through.

In the reversing type of pump, the crescent *C* and idler gear *B* are mounted on a member separate from the cover. One of the features of these pumps is that both ports are turned upward. This design results in a trap which holds a part of the liquid at all times and keeps the pump primed. In many cases, therefore, it is possible to do away with the check or foot valves usually provided in the suction pipe.

TESTER FOR WIRE-DRAWING DIES

Diamond wire-drawing dies may be tested under a "duplex" system by means of a duplex traction dynamometer manufactured by Robert Miller, 4725 Lancaster Ave., Philadelphia, Pa. This system takes into consideration the following factors in the order enumerated: (1) Tractive effort required to draw wire, expressed in pounds; (2) breaking point of wire after drawing, expressed in pounds; (3) ratio of tractive effort to breaking point, expressed in percentage; (4) surface condition of wire after drawing (found by inspecting under a magnifying glass); (5) form of wire after drawing—that is, whether round or oval; (6) size of wire after drawing—that is, correct, over-size or under-size.



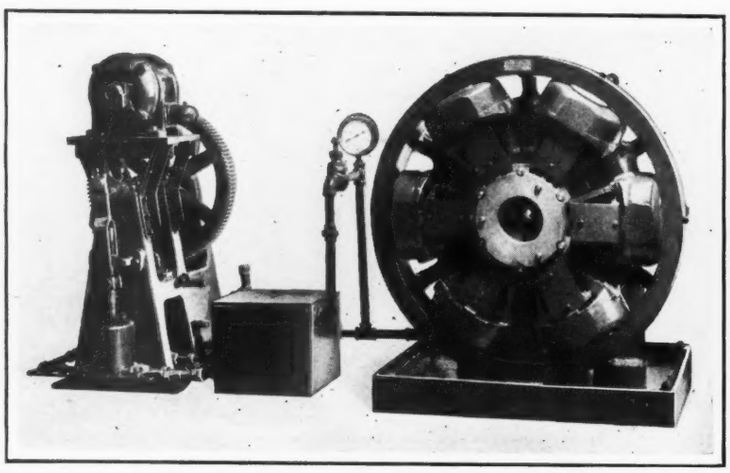
Duplex Traction Dynamometer

The only accessories necessary with this dynamometer are a micrometer and pliers. It is mentioned that a series of ten dies may be put through all the tests and inspections mentioned in less than one hour. The capacity of the device can be made to range either from 0 to 15 pounds or from 0 to 150 pounds, and the capacities can be interchanged instantly. The device weighs approximately 11 pounds.

HYDRAULIC PIPE COMPRESSING MACHINE

Ends of wrought iron pipe are compressed on cast-iron end pieces or gudgeons carrying shaft ends, by means of the machine here illustrated. This machine is a recent development of the West Tire Setter Co., Rochester, N. Y. The completed pipes are used as printing-press rolls by one manufacturer, while another manufacturer employs them in laundry machinery. Pipes from 2 1/2 to 12 inches in diameter and up to 10 or 12 feet in length, can be handled.

The compressing is done cold by hydraulic rams arranged around the interior of a heavy steel ring. This ring is mounted on a base to which the rams are connected in such a way that they move radially toward the center as pressure is built up in the cylinders. Blocks or dies of suitable size are employed in front of the rams to

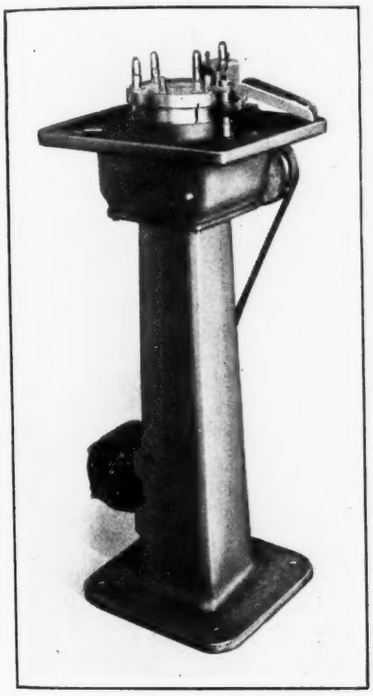


Pipe Compressing Machine Built by the West Tire Setter Co.

compress the pipe ends. A multiple-cylinder pump supplies the pressure. It will be evident from the illustration that pipes are held horizontally for the operation.

NOBLE & WESTBROOK MARKING MACHINE

A machine designed for marking short cylindrical parts on a production basis has recently been developed by the Noble & Westbrook Mfg. Co., Hartford, Conn. This No. 21 "Rapid Production" machine is capable of marking a large variety of parts, such as ferrules for tool handles, light sockets, parts of automobile cigar lighters, bronze bushings, and spark-plug parts.



Noble & Westbrook Marking Machine

The machine is usually motor-driven, as illustrated. A horizontal revolving dial carries the work pieces across the face of the marking die. When parts such as ferrules or other tubular pieces require support from within, they are placed on mandrels like those shown on the dial. After being marked, the work pieces are automatically unloaded by means of a cam-operated device. It is said that about 125 pieces can easily be marked per minute with one operator. The weight of the machine is about 200 pounds, and it occupies a floor space of approximately 20 by 24 inches.

TRENT ELECTRIC MELTING POT

Another electrically heated melting pot has recently been added to the line manufactured by the Harold E. Trent Co., 259-261 N. Lawrence St., Philadelphia, Pa. This pot will hold 100 pounds of lead and, in addition, tin, babbitt, solder, and similar metals can be melted. Salts requiring a temperature of less than 1000 degrees F. can also be melted.

The pot is equipped with a cast terminal box having an outlet in the bottom which can be arranged for a BX connection or with a rigid metal conduit. The terminals are placed horizontally to facilitate connection and inspection.

Another feature of the pot is its portability. When required, eyebolts are secured to the rim as shown. These are useful in pouring direct from the pot into a bearing. The crucible is a special grade of cast iron, while the casing is made of sheet steel. The use of a temperature control with this large sized pot is recommended. It is stated that when sufficient energy is put into a pot to heat 100 pounds of metal, there should be provision to prevent overheating, which might damage the pot or cause losses of the metal that is being melted.

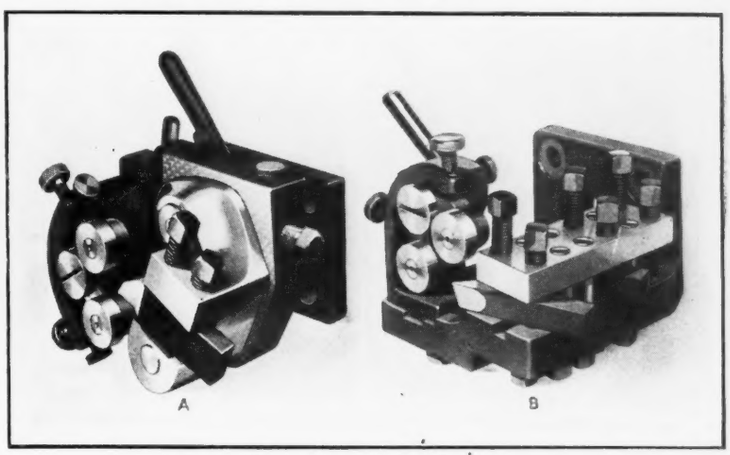
Trent Large-size Melting Pot

WARNER & SWASEY CUTTER TURNERS

Single-cutter and multiple-cutter turners of the designs illustrated at *A* and *B*, respectively, have recently been added to the line of bar tools manufactured by the Warner & Swasey Co., Cleveland, Ohio. The single-cutter turner is designed for turning bar work to a single diameter, taking either heavy or light cuts. The cutter is carried in a block which swings about a hardened and ground stud, the cutter being held in an open slot by means of two screws. The construction permits of turning close to shoulders, collets, or a fixture. Two rolls are provided on a roller back-rest and the cutter can be set to precede or follow these rolls. This cutter-block is easily adjusted for various diameters, and is quickly withdrawn after taking a cut, to prevent marring the work.

The rolls of the back-rest reduce friction and permit the use of the tool with high work speeds. These rolls are adjusted by screws, and are clamped in position by means of a binder handle. Stock smaller in diameter than the turret hole may be extended through a hole in the tool body.

The multiple-cutter turner is designed for taking two or more cuts simultaneously on bar stock or forgings. This turner consists of three parts—the body, the top plate, and the roll carrier. The cutters are plain bits, which can be quickly set in various combinations. Screws in the top plate are employed for holding the cutters in different positions, while spacer bushings between the top plate



Warner & Swasey Single- and Multiple-cutter Turners

and the body prevent springing. Cuts can be taken close to shoulders, collets, or a fixture, with this turner also.

The rolls on the back-rest are adjustable for various diameters, and the back-rest holder itself is adjustable longitudinally on the body. If necessary, two back-rest holders, each equipped with two rolls, may be used. As in the case of the single-cutter turner, long stock smaller in diameter than the turret hole can be extended through the hole provided in the tool body.

For quantity work, single-purpose cutter-blocks can be substituted for the standard blocks, these single-purpose blocks being located by a tongue which fits the groove in the tool body.

POWER BENDING AND STRAIGHTENING PRESSES

Flexible power presses of 3 and 60 tons capacity, respectively, which are intended for bending, straightening, and assembling operations on a wide variety of parts, have recently been added to the line of presses built by the General Mfg. Co., 6436 Farnsworth Ave., Detroit, Mich. The 60-ton machine illustrated in Fig. 1 may be employed for straightening heat-treated and other parts, such as automobile front axles and rear-axle shafts, but it is also applicable in other than automobile shops.

Like all other presses built by the same company, this machine is equipped with a brake-band, which makes it possible to apply a pressure of only a few pounds or the full capacity. The pressure applied depends upon the force with which the operator depresses the foot-pedal. When he releases this pedal, the ram returns to its upper position.

The power is transmitted from the rear drive head, through a rocker arm having a leverage of 2 1/2 to 1, to the main front ram. Four posts hold down the bearing in the center of the rocker arm. The ram is equipped with a nose-piece which can be easily replaced or changed to suit work. Some of the important specifications of this machine are as follows: Maximum stroke of ram, 4 inches; recommended speed of ram, 48 inches per minute; maximum distance from table to ram, 21 inches; distance from center of ram to front of column, 6 7/8 inches; maximum radius of work, 10 1/2 inches; and weight of belt-driven machine, 6600 pounds.

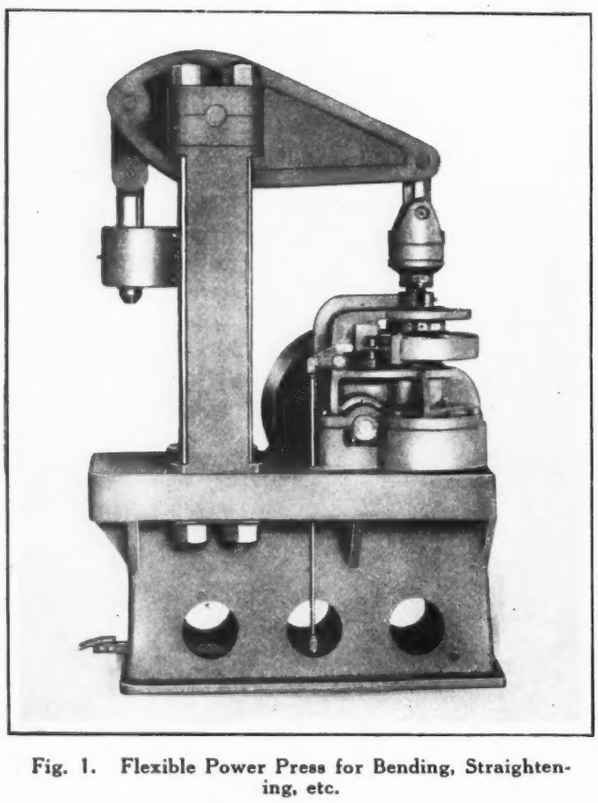


Fig. 1. Flexible Power Press for Bending, Straightening, etc.

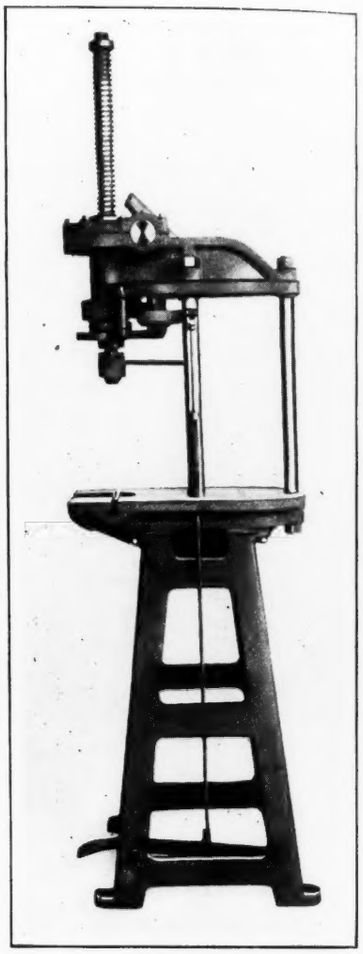


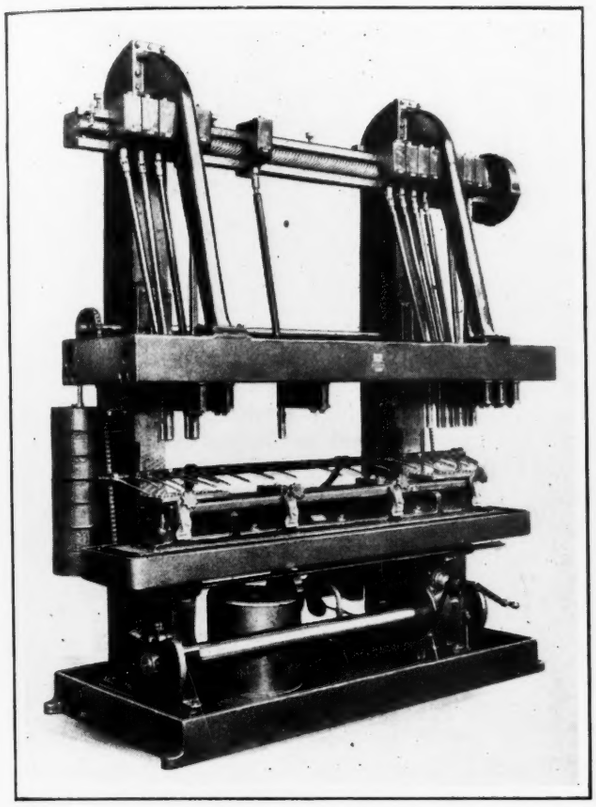
Fig. 2. Three-ton Flexible Press

The 3-ton press, illustrated in Fig. 2, is of the screw type and is provided with three posts. It is similar to the 8- and 20-ton, three-post presses manufactured by the same company. The power applied by this machine also depends upon the force with which the operator depresses the foot-pedal. Fixtures can be furnished to permit the straightening and testing of work held on centers. The head is a complete unit, which can be used with many special fixtures.

Some of the important specifications of this machine are as follows: Maximum stroke of ram, 6 inches; recommended speed of ram, 135 inches per minute; maximum distance from table to ram, 12 inches; distance from center of ram to front of posts, 6 7/8 inches; and weight of belt-driven machine, about 700 pounds. When desired, this machine can also be built with a maximum ram stroke of 9 or 12 inches, and with any desired maximum opening between the ram nose and the table.

MOLINE NEW-TYPE DRILLING MACHINES

Drilling machines equipped with spindles which are driven from a spiral shaft through gears, universal joints, and telescopic shafts, are being introduced to the trade by the Moline Tool Co., Moline, Ill. These machines are built in many sizes and types. They have from one to four columns, and vary from 2 to 24 feet in length. Either a table feed may be provided for carrying the work to the drills or a rail feed for carrying the drills to the work. The feed may be obtained hydrauli-



Moline Drilling Machine with Adjustable Spindles Driven from Spiral Shaft

cally or through a cam or rack and pinion mechanism.

Horizontal and vertical styles are included in the line. The machine illustrated is of the vertical type, and is equipped with a jig and the necessary spindles for drilling tractor frames. The main drive shaft is mounted in radial ball bearings, and is driven by belt either from a countershaft or motor. The drive shaft is geared to the main spiral shaft, which is hardened and lapped.

Each spindle is provided with an independent driving unit in which a bronze gear meshes with the spiral shaft. The individual units are adjustable laterally along the upper rail. Oiling of the unit heads and the universal joints is accomplished by means of a centralized wick system. The lower rail is provided with two T-slots on each side for clamping the individual bronze-bushed spindle housings.

The great distance between the universal joints, together with the adjustable driving heads, makes any set-up possible with the telescopic shafts at only a slight angle. This feature eliminates excessive wear of the joints. The spindles can be adjusted vertically 1 1/2 inches to take care of different drill lengths, while the minimum center-to-center distance between the spindles of the machine illustrated is 1 3/4 inches.

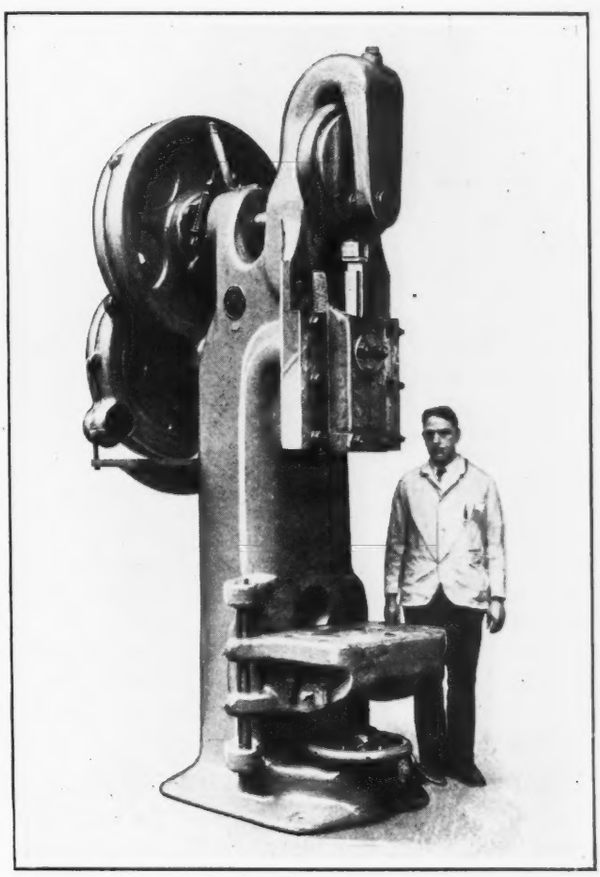
The table mechanism is of standard construction, the cams being designed to give the table a quick approach, slow feed, and quick return. There is a 5-inch vertical adjustment of the table independent of the cams. The jig is made to accommodate both right-and left-hand tractor frames. Clamping of the work is accomplished by means of four screws which clear the work when they are loosened. The work rests on hardened vees, and the jig is relieved at an angle to drain off chips and cutting compound. On the machine illustrated, holes can be drilled anywhere within a rectangle 12 inches wide by 8 feet long.

FERRACUTE LONG-STROKE PRESS

A series of presses having an unusually long stroke and other special features has recently been placed on the market by the Ferracute Machine Co., Bridgeton, N. J. A press of this series is here illustrated. It is equipped with an adjustable bed, the height of which from the top to the floor can be varied from 25 to 33 inches. When not in use, the bed may be swung to one side. Heavy bolts secure the bed to the frame, and planed guides at the back of the bed insure alignment.

The stroke of the ram is 12 inches, an eccentric keyed to the shaft, giving this long stroke. The distances from the bed to the ram are also greater than usual. Safety features of this machine include a webbed flywheel and gear, both of which are encased in guards. The press is equipped with a shelf to receive a motor. The drive from the motor to the machine is through a rawhide pinion which engages with teeth cut around the rim of the flywheel.

The overhanging shaft box is another unusual feature of this press. While the press has been primarily designed for certain forming operations in automobile factories, it is suitable for a wide range of work. Horning operations may be performed with a horn assembled in the hole provided at the front of the frame. The press weighs approximately 15,300 pounds.

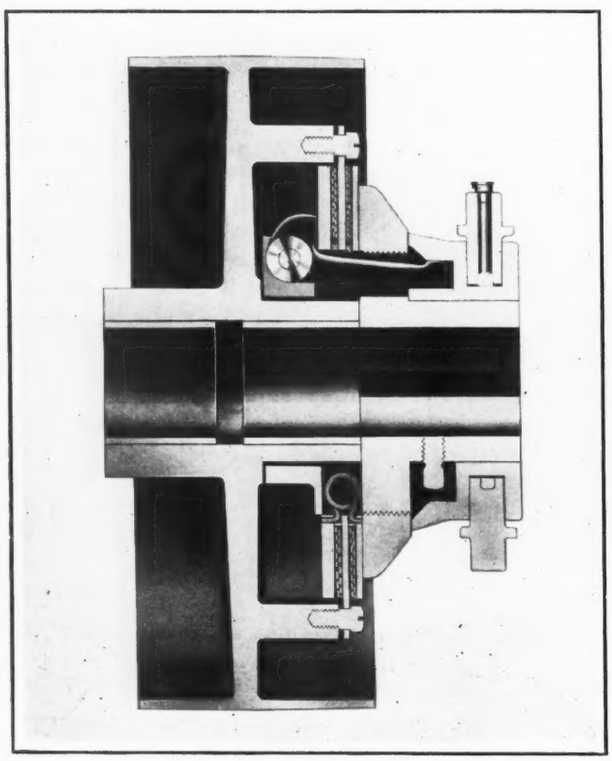


Ferracute Press Having a Long Ram Stroke

CONWAY DISK CLUTCHES

Single- and multiple-disk friction clutches (the single-disk type being shown in the accompanying illustration) have been developed by the Conway Clutch Co., 1962 W. 6th St., Cincinnati, Ohio. It will be seen that the exterior of the clutch is finished to give the features of safety, simplicity, and balance. The actuating members are completely enclosed, and their design provides convenient means of adjustment.

Positive clamping of the clutch is assured by the use of a split ring having a smooth surface. Three actuating levers are employed, and their ratio is such that only a slight pressure is required to engage the drive. Centrifugal force acting on these levers would disengage the clutch when the cone



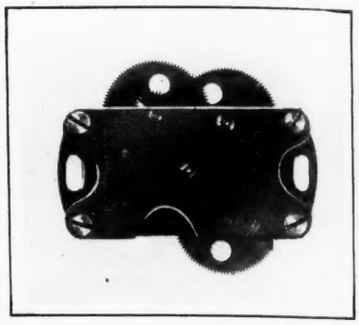
Conway Single-disk Friction Clutch

was withdrawn, even though there were no springs to force the plates apart. Vibration cannot cause the cone to withdraw, as the deflection angle of this member is sufficient to hold it in place until the shifting lever is operated.

In working out the design of this clutch, special attention was given to providing for the easy disassembly of all parts. The disks are made of heat-treated steel and lined with woven asbestos. The disk faces are ground to prevent any dragging action against the asbestos lining. In the multiple-disk clutch, the steel disks run in oil. The body of the clutch is counterbored to permit extension of the pulley under the point of frictional contact. This construction saves considerable floor space.

FEDERAL INDICATOR IMPROVEMENTS

Indicators manufactured by the Federal Products Corporation, Providence, R. I., are now provided with four sapphire jewel bearings. It has been the experience of this concern that when indicators are used for checking work while the work is being produced in a machine, the wear on the small indicator pivots and on the bearings in which the pivots rotate is extreme, when the bearings are made of bronze or brass. For this reason, sapphire jewel bearings have been adopted. The mechanism of Federal indicators has always been contained between a top and bottom plate entirely separate from the case, similar to the construction of watches. The jewel bearings make the construction still more like that of a watch.

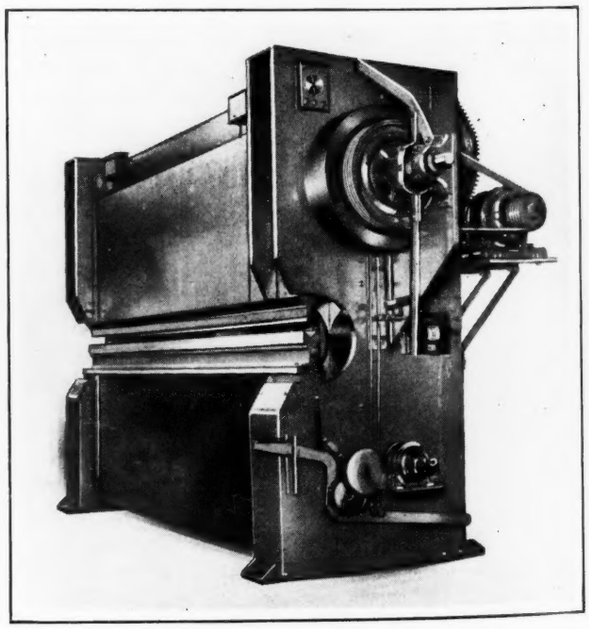


Movement of a Federal Indicator

DREIS & KRUMP PRESS BRAKE

A toggle-motion double-housing gap press brake for making heavy or multiple bends in one stroke has been added to the line of press brakes built by the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill. It is claimed that the toggle motion of this press increases the pressure at the bottom of the stroke where the final bend is made. Each housing is constructed of two steel plates which are spaced with heavy channels. There is an independent driving unit mounted within each housing. These units are connected with the drive shaft on which a flywheel and clutch are mounted.

There is a direct motor-to-flywheel drive through "Texrope" running over cast-iron sheaves. One sheave is mounted on the motor shaft and the other on the clutch rim of the flywheel. The flywheel revolves on Timken roller bearings. An eccentric, mounted on the bull gears, actuates steel connection straps which drive against the toggles and operate the ram. The toggles are so located that they do



Dreis & Krump Toggle-motion Press Brake

not completely straighten when the ram is down, and thus there is no possibility of the ram being jammed on dead center when too close an adjustment has been made.

Adjustments for various heights of dies and thicknesses of metal are obtained through a small independent reversible motor which drives through reducing spur gears and worm-gears. A worm-gear serves as a nut to raise or lower a screw that supports the bed. Adjustments can be made independently at each end or in unison. Lubrication is provided to bearings and slides by a Madison-Kipp forced-feed oiler.

This machine is built in various lengths up to 14 feet and in various capacities for bending steel plates up to 1/2 inch thick. A single-housing eccentric press brake is built for light work.

HISEY GRINDING AND BUFFING MACHINES

A new line of motor-driven grinding and buffing machines has recently been brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio. Fig. 2 shows a floor stand grinding machine of this line, equipped with two wheels. This grinder is built in five sizes for wheels 7, 10, 12, and 14 inches in diameter, with face widths ranging from 3/4 to 2 1/2 inches. The 7-, 10- and 12-inch sizes are also made in bench styles.

Fig. 1 shows a floor stand buffing and polishing machine with open spindle extensions. This machine is also made in five sizes for wheels 8, 10, 12, 14, and 18 inches in diameter and from 1 to 3 inches in face width. The two smaller sizes are also built in bench models. A similar buffing and polishing machine, with the exception that the spindle extensions are enclosed, is illustrated in Fig. 3. This machine is built in four sizes for wheels 10, 12, 14, and 18 inches in diameter, with face widths of from 1 1/2 to 3 inches. A 10-inch machine of this design may be obtained in a bench type.

All these machines can be furnished with both alternating- and direct-current motors. For single-phase alternating current, the machines are equipped with improved commutating-type repulsion induction motors, while squirrel-cage motors are furnished for two- and three-phase alternating current. Ball bearings are provided for the grinding or buffing spindles and, in the case of the buffing machine with the enclosed spindle extensions, four ball bearings are supplied.

* * *

NEW MACHINERY AND TOOLS NOTES

Floor Grinder: Safety Emery Wheel Co., Springfield, Ohio. A floor grinder in which the proper operating speeds for different sizes of grinding wheels can be conveniently obtained. The machine is driven by a motor mounted within, which is connected to the spindle through a silent chain. Any practical grinding wheel speed is obtained by merely changing sprockets. This machine is built in four sizes for wheels ranging from 14 to 30 inches in diameter and for motors of from 3 to 15 horsepower.

Flywheel Tooth-Rounding Machine: W. C. Lipe, Inc., 208 S. Geddes St., Syracuse, N. Y. A machine for chamfering the teeth of the ring gears used in automobile flywheels. The ring gear is clamped in place by means of an air chuck, and the tool consists of a formed hollow mill which cuts only on one side of the teeth. The burr is thrown to the outside, where it can be easily removed with a file or on a surface grinder. After the ring gear has been placed in the machine, the operation is entirely automatic.

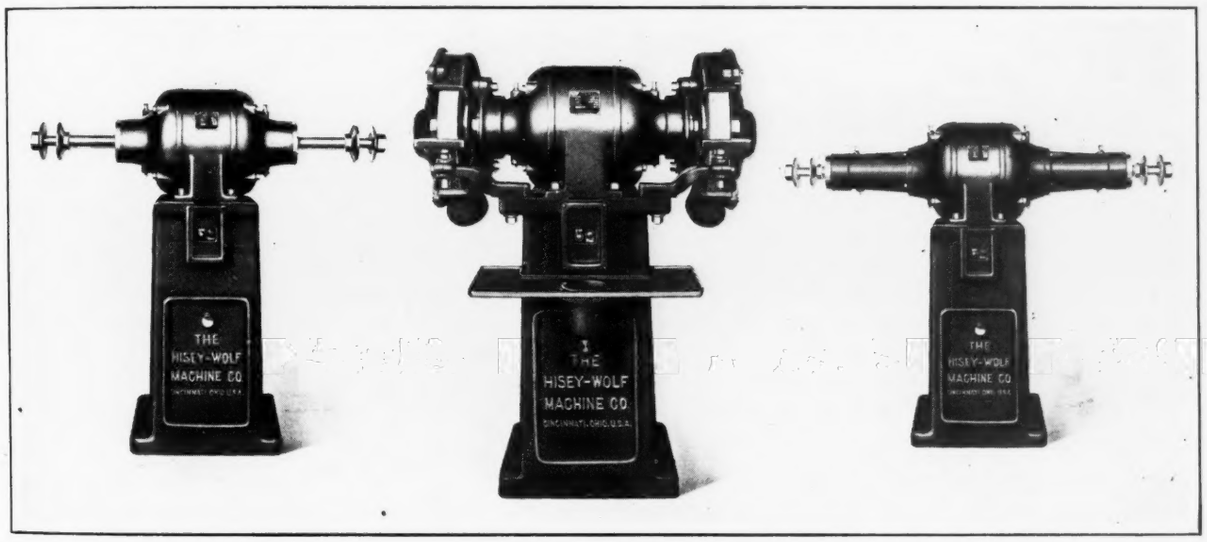


Fig. 1. Hisey Buffing Machine with Open Spindle Extensions

Fig. 2. Motor-driven Floor-stand Grinder

Fig. 3. Buffing Machine with Encased Spindle Extensions

* * *

More than 300,000,000 ordinary electric lamps and over 200,000,000 miniature electric lamps, such as are used for automobiles, flashlights, etc., were produced in the United States last year. It is estimated that throughout the remainder of the world, the number of large lamps used is about equal to the quantity used in this country, but that the total of miniature lamps is about one-fourth the number used here, so that the present annual production of all kinds of incandescent electric lamps throughout the world would aggregate about 900,000,000 lamps.

The New Process of Chromium Plating

ENGINEERS and manufacturers are always interested in any process that produces on metals, surfaces that resist either wear or oxidation to an unusual degree. The success of chromium plating as applied to printing plates requiring exceptional durability indicates that this process might be utilized to advantage in connection with various branches of machinery manufacture. Although little definite information is available concerning the application of chromium plating outside of the printing field, there have been enough tests and experiments to indicate at least promising possibilities.

At the annual meeting of the American Society of Mechanical Engineers, William Blum of the Bureau of Standards, presented a paper on chromium plating. It was explained at the outset that experiments with chromium plating have not been complete enough to determine definitely what applications it will have in the general field of engineering, although it seems evident that there may be important applications in this direction.

The advantages of chromium plating are indicated by the properties of chromium-plated surfaces. Such surfaces are unusually hard, and they also resist tarnishing and corrosion, although chromium plating possesses no exceptional properties in the latter respect, as compared, for example, with a nickel-plated surface. Evidently, there has been some misunderstanding on this point, and Mr. Blum pointed out that chromium plating does not protect steel better than nickel-plating; hence it is not an absolute protection against corrosion.

In order to test the resistance of chromium plating, three samples having deposits of different thicknesses were exposed to the atmosphere for a period of seven weeks. One sample having a deposit 0.00025 inch thick was badly corroded after seven weeks' exposure; the second sample having a deposit 0.0005 inch thick resisted corrosion fairly well; and the third sample having a deposit 0.001 inch thick was not injured by the exposure.

It will be understood that the chromium is deposited by the electroplating process, the general equipment being similar to that used for other kinds of plating. A tank of stoneware is preferable, and the results obtained are affected by the temperature of the bath and the current density, more than in ordinary electroplating. The hardest deposit of chromium is obtained at the highest current density that can be applied without "burning." A temperature for the bath of about 45 degrees C. (113 degrees F.) and 100 amperes per square foot gives a very bright deposit.

The "throwing power" of the chromium plating process is relatively poor, which means that it is comparatively difficult to deposit the chromium in recesses or on parts of irregular shape. This difficulty seems to be inherent, and it is doubtful if it can be eliminated.

The power cost for chromium plating is estimated to be five to ten times greater than for nickel plating, although, it still may be a relatively small item. It is estimated that chromium plating will cost about 3 cents per square foot for a coating 0.001 inch thick, which is unusually heavy. These cost figures indicate that chromium plating is not a cheap substitute for nickel plating, but the chromium surface is preferable, at least for certain special applications, particularly when hardness is a desirable property. It has been found, for example, that the plates used in printing money, which have a deposit of 0.0002 inch chromium, last three or four times as long as nickel plates, and about twice as long as casehardened steel.

Little has been determined as yet concerning possible applications to machine parts and to tools, such as gages, dies, etc. It has been suggested that chromium plating may prove valuable in restoring worn working gages by adding a coating of chromium and then lapping the gage to the required size. Such restoration of gages may be repeated by first removing the old coating of chromium by the application of hydrochloric acid. Although it is possible to apply chromium on a previously chromium plated surface, it is considered preferable first to remove the old coating with hydrochloric acid, as described.

Some experiments with dies indicate that chromium plating may prove valuable for certain types of dies, although its value is doubtful as applied to stamping dies in general, as the lack of throwing power, previously mentioned, makes it difficult to deposit the chromium in recesses or on irregular shapes. It is probable that the most important application in this field would be to certain types of drawing or other dies having surfaces that are subjected to unusual wear and that are so located as to permit a protecting layer of chromium to be deposited.

Chromium plating has been applied successfully to rubber molds, as it resists the action of sulphur. It has also proved successful for plumbing fixtures, and in the discussion of this paper, reference was made to a large hospital and also to a hotel, as well as other buildings, now equipped or being equipped with chromium plated fixtures.

If desired, a chromium coating up to at least 0.005 inch thick may be deposited, and while this may not represent the maximum, it is doubtless thicker than would be required in commercial work. Brightness of the surface is sacrificed with increase of thickness. Local plating may be done by covering the surfaces that are to be remain unplated with a suitable resist. The uniformity of the plating or chromium deposit is governed by the shape of the surface. The variation on a cylindrical surface is not over 25 per cent, which would not be serious even on precision tools, such as gages, etc., when suitable allowance is made for obtaining the final size by lapping.

PRICES OF RAW MATERIALS

The prices of raw materials, such as pig iron, steel scrap, bars, sheets, etc., have undergone some radical changes during the last thirty years, as shown by the accompanying table, which contains data secured from Oliver Bros., Inc., 71 Murray St., New York City. This table, as will be seen, gives the prices for September, 1926, and also the highest and lowest prices since 1897, some materials having advanced approximately 500 and 600 per cent from the lowest price in 1897 to the highest in 1917. These prices relate to domestic business only. The highest prices for most of the materials listed occurred in July, 1917; in November, 1917, the prices of most of these items were regulated by the Government. At present, prices are, generally speaking, remarkably stable, and the prospects for 1927 indicate continued stability.

VARIATIONS IN PRICES OF RAW MATERIALS DURING THIRTY YEARS

Material	Price Based F. O. B.	Prices in Dollars per Gross Ton (2240 Pounds)		
		Sept., 1926	Lowest since 1897	Highest since 1897
Pig iron, basic	Valley	19.26	11.00–July, 1904	34.00–July, 1917
Foundry pig iron No. 2	Chicago	21.25	11.00–Dec., 1897	55.00–July, 1917
Bessemer pig iron	Pittsburg	20.38	10.00–Dec., 1897	56.95–July, 1917
Steel billets—Bessemer	Pittsburg	35.00	14.90–Dec., 1897	95.00–July, 1917
Wire rods	Pittsburg	45.00	20.25–Nov., 1898	100.00–July, 1917
Heavy steel scrap	Chicago	14.25	7.25–Nov., 1898	43.00–June, 1917
Material	**Price Based F. O. B.**	**Prices in Dollars per Hundred Pounds**		
		Sept., 1926	Lowest since 1897	Highest since 1897
Common iron bars	Pittsburg	2.250	0.95–Dec., 1897	5.25–July, 1917
Merchant steel bars	Pittsburg	2.000	0.95–Dec., 1897	4.50–July, 1917
Structural material	Pittsburg	2.000	1.05–Dec., 1897	4.50–July, 1917
Steel sheets, No. 28, black	Pittsburg	3.100	1.70–May, 1915	9.00–July, 1917
Steel sheets, No. 28, galv.	Pittsburg	4.300	2.75–July, 1914	11.00–July, 1917
Copper, ingot	New York	14.187	10.75–Dec., 1897	36.00–Mar., 1917
Spelter, zinc	St. Louis	7.423	3.75–Dec., 1897	27.00–June, 1915
Lead, pigs	St. Louis	8.522	3.35–Oct., 1914	12.00–June, 1917
Tin, pigs	New York	68.923	13.70–Dec., 1897	110.00–May, 1918

* * *

AUTOMOTIVE ENGINEERS' ANNUAL MEETING

The annual meeting of the Society of Automotive Engineers will be held in the General Motors Bldg., Detroit, Mich., January 25 to 28. Technical sessions will deal with training, production, brakes, light cars, transmissions, research, body building and design, chassis design, and engines. An especially interesting paper will be presented by Alan Fenn, formerly general manager of Clement Talbot, Ltd., and now with Sunbeam-Talbot-Darracq, who has accepted an invitation to come to the annual meeting as the guest of the society to present a paper on the light car as it is known in England, the reasons for its development in that country, and the advantages of this type of car from the user's standpoint. With the trend in this country toward the light car, this paper will doubtless prove of great interest. This session will also include a paper by F. Sergardi. The complete program for the annual meeting will include thirty papers. More complete information can be obtained from the headquarters of the Society of Automotive Engineers, 29 W. 39th St., New York City.

PINIONS CUT FROM ENLARGED BLANKS

By A. H. CANDEE, Engineer, Gleason Works, Rochester, N. Y.

In the article "Pinions Cut from Enlarged Blanks" in November MACHINERY, page 192, the following statement was made: "An over-size pinion can be hobbed on a hobbing machine, but only with a special hob. This special hob has the standard depth, but must be cut with a special pressure angle and with a special thickness at the pitch line to suit the particular gear with which the over-size pinion must mesh." The present writer feels that this statement should be corrected, because hobbing is a true generating process, and as such is just as capable of cutting involute gears with modified diameters—or, in other words, with long and short addenda—and with correct tooth profiles, as gear generating processes employing either rack-shaped or pinion-shaped cutters.

The hobbing of enlarged pinions and gears with addenda different from standard, using standard hobs has long been common practice among gear manufacturers, and in the book "Gear Cutting Processes," by F. D. Jones, associate editor of MACHINERY, a description of the hobbing of spur pinions with enlarged diameters will be found on pages 107 to 110. Similar practice in hobbing herringbone gears is mentioned on pages 231 and 232.

The value of the system explained in the article referred to in November MACHINERY would be enhanced by including the required tooth thickness measurements and the depth of cut in the data given for the shop. The correct tooth thickness can easily be calculated in the engineering department, and should not be left for the gear-cutter operator to obtain by the "cut-and-try" method.

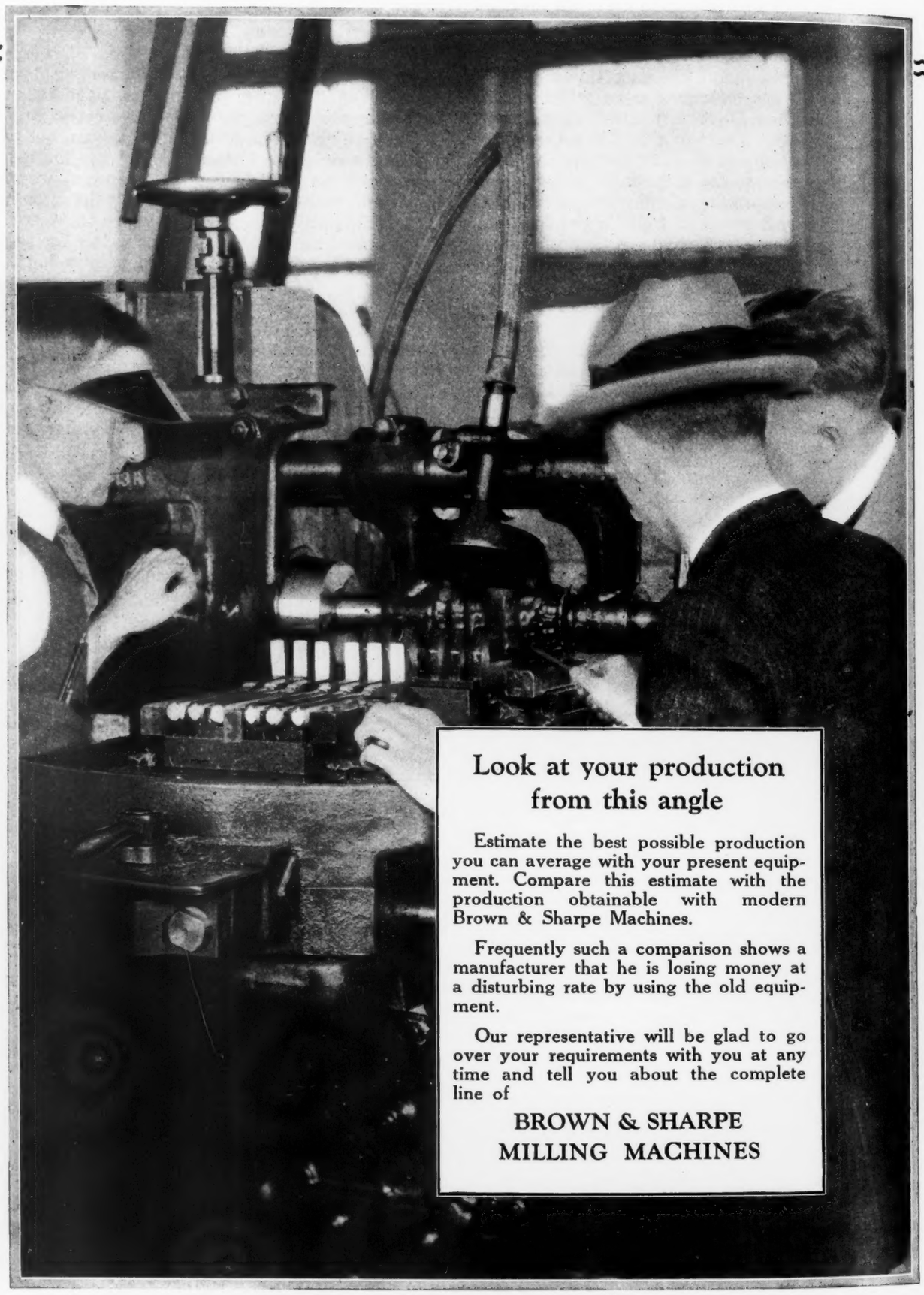
* * *

EXHIBITION OF MACHINERY MODELS

The tenth annual exhibition of models, tools, and electrical apparatus was held by the Chicago Society of Model Engineers at 846 Rush St., Chicago, Ill., December 1 to 4. The exhibit was composed of models of many different kinds, the majority being in the steam engineering class. The average scale of the models was about 1/2 inch to the foot. Among the objects exhibited were four locomotives, one steam traction engine, one steam road roller, two gasoline engines, and a dozen steam engines and boilers of various types. Nearly all of the engines were shown in operation, being run by compressed air.

* * *

"How Your Radio Set is Built" will be the leading article in February MACHINERY. In these days, when all mechanical men are interested in radio, few readers will want to miss that article.



Look at your production from this angle

Estimate the best possible production you can average with your present equipment. Compare this estimate with the production obtainable with modern Brown & Sharpe Machines.

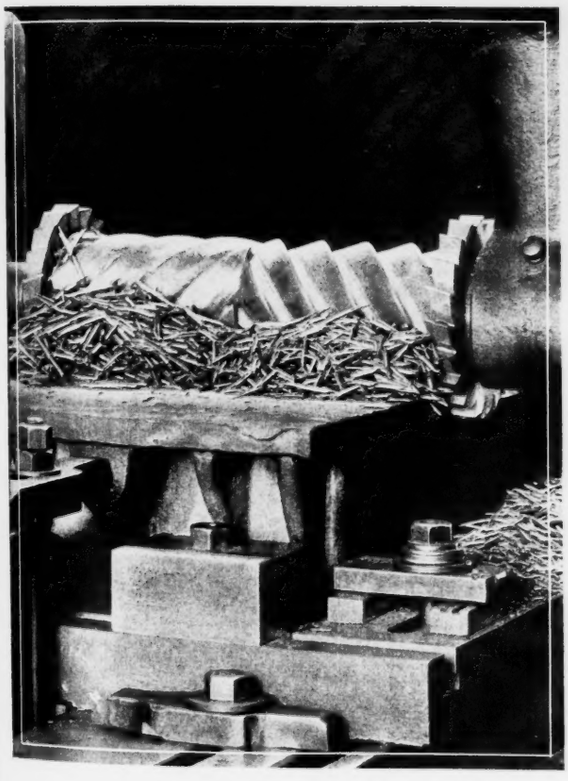
Frequently such a comparison shows a manufacturer that he is losing money at a disturbing rate by using the old equipment.

Our representative will be glad to go over your requirements with you at any time and tell you about the complete line of

BROWN & SHARPE MILLING MACHINES

The machine shown at work above is one of a battery of Brown & Sharpe No. 13B Plain Milling Machines used for milling wrenches at a high production rate. Special fixtures designed by Brown & Sharpe engineers, in conjunction with the up-to-the-minute machines, brought the cost down to a new low record.

The chips tell a convincing story of Production



The chips piled up by these cutters are good evidence of their profitable performance. The Brown & Sharpe Staggered Tooth Cutter shown above is taking a cut 1⅛" wide and 2" deep in steel. Production jumped 40% when it was put on the job.

Two opposed Helical Mills and Two Single Side Side Milling Cutters were combined to take the cut shown at the left. They are shearing out 25½ cubic inches of cast iron per minute, and when they replaced the former set-up a 100% production increase was reported.

Check up on the jobs in your plant where Brown & Sharpe Cutters can boost your production—and profit.

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

The Brown & Sharpe No. 30 Small Tool Catalog describes over 1500 sizes and styles of Cutters and Hobs and contains considerable cutter information. You should have a copy for reference purposes. If your dealer cannot furnish a copy, write us direct.

PERSONALS

WALTER B. HAISLUT, general sales manager of the Diamond Chain & Mfg. Co., Indianapolis, Ind., has just returned from a three months' business trip to Europe.

J. I. BURGESS, formerly Ohio machinery representative of the National Acme Co., Cleveland, Ohio, has become sales manager of the National Pipe Products Co., Rochester, Pa.

MELVIN A. TRAYLOR, president of the First National Bank of Chicago, was elected a director of the General Electric Co., Schenectady, N. Y. at a meeting of the board on November 24.

GREGORY J. COMSTOCK, formerly metallurgist of the International Silver Co., Meriden, Conn., has been appointed director of research of the Firth-Sterling Steel Co., McKeesport, Pa.

WALTER D. BRIGGS has resumed his position as salesman with the Syracuse office of Crane-Schiefer-Owens, Inc., Buffalo, N. Y. following an indefinite leave of absence on account of illness in his family.

J. H. RIDGE has been appointed branch manager of the Pittsburg branch of the Timken Roller Bearing Service and Sales Co., Canton, Ohio, and G. G. WESTON has been appointed branch manager of the Omaha branch.

PAUL ACKERMAN has been appointed engineer in the service department of the Timken Roller Bearing Co., Canton, Ohio. All service work of the automotive, industrial, and steel mill divisions will be coordinated under his direction.

STEWART M. BUNTING, formerly sales manager of the miscellaneous department of the Niles-Bement-Pond Co., 111 Broadway, New York City, became associated with Smith, Booth, Usher Co., Los Angeles, Cal., on January 1.

O. M. OLSEN, field engineer for the U. S. Silica Co., Chicago, Ill., has become associated with the American Foundry Equipment Co., Inc., Mishawaka, Ind., in the capacity of consulting field engineer and direct representative of the president.

BURTON L. DELACK, assistant manager of the Erie, Pa., works of the General Electric Co., has been appointed assistant manager of the Schenectady works, effective December 1. JOHN ST. LAWRENCE, general superintendent at Erie, will succeed Mr. Delack there.

E. R. STONE has been appointed manager of the stoker sales department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., to succeed the late G. A. Sacchi. Mr. Stone has been affiliated with the Westinghouse organization practically from boyhood.

OWEN K. PARMITER has been appointed metallurgical and sales engineer of the Firth-Sterling Steel Co., McKeesport, Pa. He formerly held the position of metallurgist in charge of all technical operations, and since 1919 has also been consulting expert of the American Stainless Steel Co.

FREDERICK M. FEIKER, for many years connected in an editorial and executive capacity with the McGraw-Hill Publishing Co., has been appointed managing director of the Associated Business Papers, Inc., succeeding JESSE H. NEAL, who, for eleven years, has served as executive secretary of the association.

HENRI E. NELSON has been appointed sales manager of Hardinge Brothers, Inc., 4149 Ravenswood Ave., Chicago, Ill. Mr. Nelson will be in charge of sales of bench lathes and other precision machinery. He was formerly sales engineer with the Independent Pneumatic Tool Co., Chicago, and has had long experience in engineering and shop work.

A. P. JAMES is the new executive in charge of the Pacific division offices of the Bunting Brass & Bronze Co. Mr. James has been sales manager of the automotive replacement department in the main sales offices at Toledo, Ohio. A branch sales office and a large stock of Bunting products at 198 Second St., San Francisco, Cal., will be under his management.

F. R. GAMMON has joined the sales organization of the Chicago Belting Co., 113 N. Green St., Chicago, Ill. He will be manager of the New York factory branch which has recently been moved to new and larger quarters at 75 Cliff St., New York City. Mr. Gammon was formerly connected with the Bethlehem Steel Co. as assistant manager of the semi-finished and wire department.

HAROLD D. MITCHELL has been appointed sales representative for the William Ganschow Co., Chicago, Ill., in the western half of New York state. Mr. Mitchell's headquarters will be at 1543 Fillmore Ave., Buffalo, N. Y. He has previously been associated with the Goodyear Tire & Rubber Co., the Racine Rubber Co., and the C. Kenyon Co. For the last few years he has been chief engineer of the Sumet Corporation of Buffalo.

G. M. EATON, chief mechanical engineer of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has become identified in a sales engineering capacity with the Molybdenum Corporation of America, Pittsburg, Pa. Mr. Eaton has been associated with the Westinghouse organization for twenty years, becoming chief mechanical engineer in 1919. He will continue to serve the company as consultant on mechanical engineering problems.

MEFFORD R. RUNYON has been appointed district sales manager of the Bridgeport Brass Co., for the New York Metropolitan district. Mr. Runyon has had wide experience in the brass, copper, and bronze field. He studied chemical engineering at Rutgers University, and after several years' experience as an accountant, he took up the work of reorganizing the Benson rolling mills, one of the oldest brass and bronze manufacturing mills outside of Connecticut.

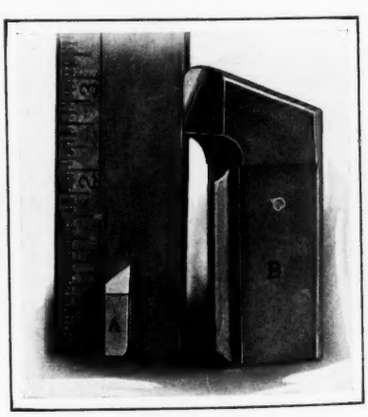
A. W. SCARRATT has been appointed assistant chief engineer of the Hyatt Roller Bearing Co., Newark, N. J. Prior to joining the Hyatt organization Mr. Scarratt spent 13 1/2 years with the Minneapolis Steel & Machinery Co. He was one of the organizers of the Society of Tractor Engineers in Minneapolis, and a prime mover in merging that society with the society of Automotive Engineers. He is secretary of the Minneapolis section of the Society of Automotive Engineers.

GEORGE M. BAKEWELL has been placed in charge of the export department of the Bunting Brass & Bronze Co. of Toledo, Ohio. He was formerly overseas representative of the Champion Spark Plug Co. of the same city. Just before joining the Bunting Brass & Bronze Co., Mr. Bakewell completed his third trip around the world, visiting all the important places of commerce and industry. He will make his headquarters at the export offices of the Bunting Brass & Bronze Co., 254 W. 54th St., New York City.

* * *

DEVELOPMENTS IN CIRCULAR SAWS

The accompanying halftone illustrates in a striking manner the developments made in recent years in inserted-tooth circular saws for cutting metal. At *A* is shown a small tooth 1 inch high which weighs 1/4 ounce. At *B* is shown a tooth 3 inches high which weighs 1 pound. These are the smallest and the largest teeth used in the Disston inserted-tooth saws made by Henry Disston & Sons, Inc., Tacony, Philadelphia, Pa. Between the two extremes shown, of course, run a large number of sizes.



Comparison of Disston Saw Teeth

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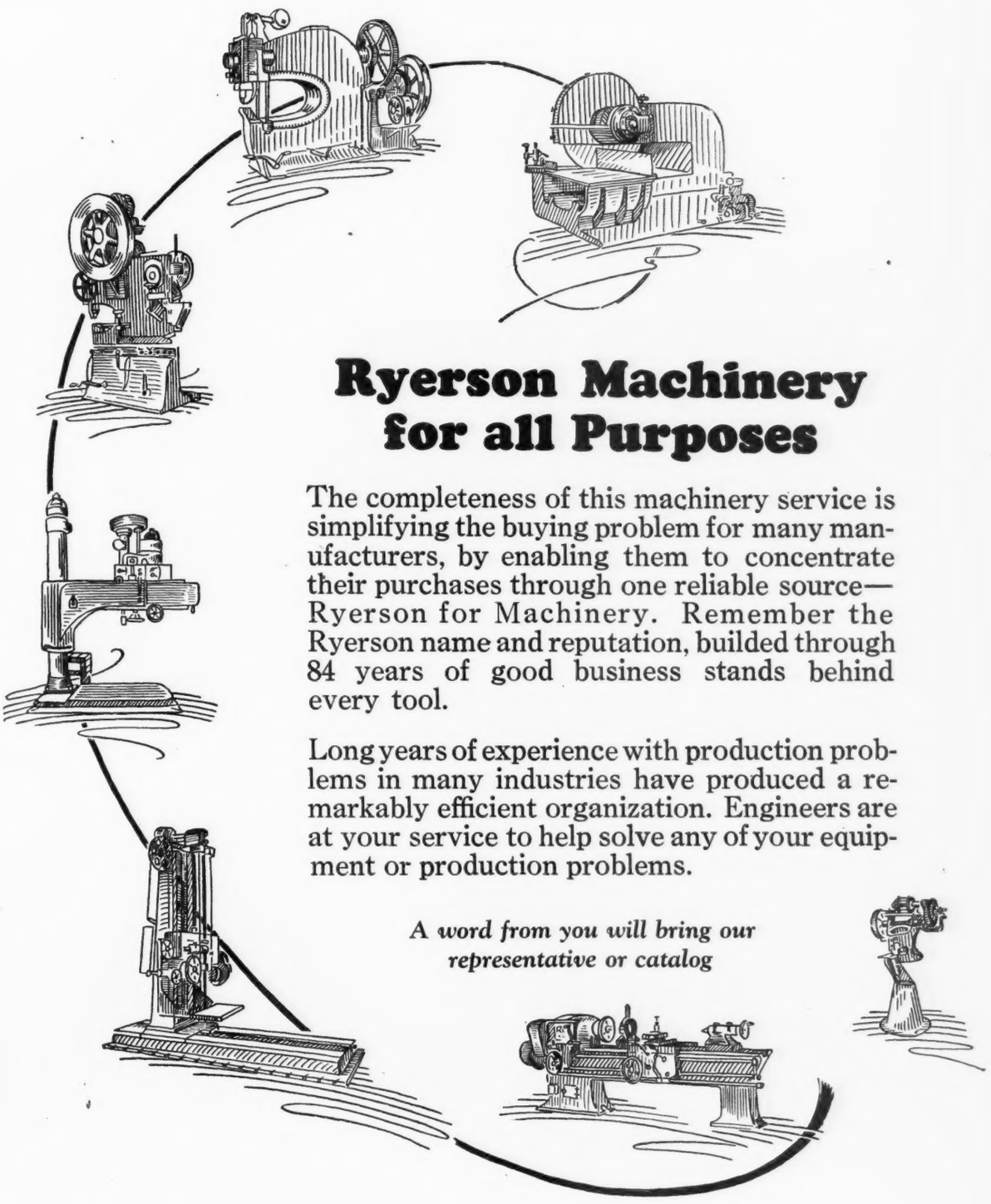
CLEVELAND MACHINE TOOL EXPOSITION

The definite plans for the machine tool exposition to be held by the National Machine Tool Builders' Association at Cleveland, Ohio, September 19 to 24, are rapidly being completed. The exhibition space available allows 58,250 square feet of actual booth area. Of this, definite reservations had already been made for 52,000 square feet, or practically 90 per cent, on December 15. These reservations have come from over one hundred members of the association and about forty non-members. In addition, tentative applications for space have been made by even a larger number of concerns than there are booths available, and the space will therefore be completely sold out at an early date.



Ryerson Machinery for all Purposes

The completeness of this machinery service is simplifying the buying problem for many manufacturers, by enabling them to concentrate their purchases through one reliable source—Ryerson for Machinery. Remember the Ryerson name and reputation, builded through 84 years of good business stands behind every tool.

Long years of experience with production problems in many industries have produced a remarkably efficient organization. Engineers are at your service to help solve any of your equipment or production problems.

A word from you will bring our representative or catalog

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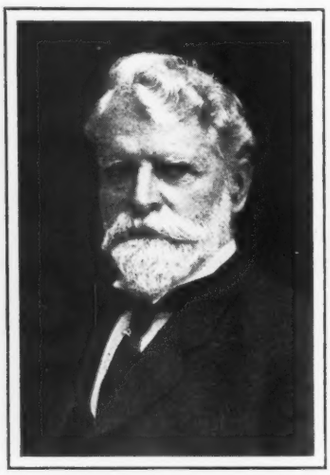
Serpentine Shears
Hydraulic Machinery
Spring Shop Equipment
Flue Shop Equipment

AMBROSE SWASEY'S EIGHTIETH BIRTHDAY

On December 19, Ambrose Swasey, one of the founders of the Warner & Swasey Co., Cleveland, Ohio, celebrated his eightieth birthday. Mr. Swasey was born December 19, 1846 at Exeter, N. H. When eighteen years old, he began an apprenticeship with the Exeter Machine Works. Here he met as a fellow apprentice, Worcester R. Warner, who was destined to become his life-long friend and business associate. In 1870 both men entered the employ of the Pratt & Whitney Co., Hartford, Conn.

In 1880, Mr. Swasey left the Pratt & Whitney Co., joining with Worcester R. Warner in the establishment of a business under the firm name of Warner & Swasey. Foreseeing the growth of the West, the business was first located in Chicago, but discovering that at that time the class of workmen they required were not available in that city, they moved to Cleveland in 1881, and built their first shop on a portion of the site still occupied by their present plant.



In addition to building the well-known line of Warner & Swasey machine tools, the company has engaged in the building of telescopes, and some of the largest and best known telescopes in the world were produced at the Warner & Swasey plant. In addition, transits, meridian circles, and astronomical and other instruments were developed and built at the plant.

Mr. Swasey has always given generously of his time to the development of professional and scientific societies. He is a past president and honorary member of the American Society of Mechanical Engineers and of the Cleveland Engineering Society, and an honorary member of the American Society of Civil Engineers. He has received distinguished honors in many different parts of the world. In 1901 he received from the French Government the decoration of Chevalier of the Legion of Honor, and in 1921 he was made an officer of the Legion of Honor. In 1914, Mr. Swasey provided the generous, initial fund which established the Engineering Foundation.

* * *

TRADE NOTES

PACIFIC COAST FOUNDERS ASSOCIATION has established offices at 55 New Montgomery St., San Francisco, Cal.

WETMORE REAMER CO., 60 27th St., Milwaukee, Wis., announces that after January 1 the company will be represented in the Michigan territory by Rummins & Murray Inc., 4829 Woodward Ave., Detroit, Mich.

UNION MFG. CO., New Britain, Conn., has appointed the Mountain States Rubber Co. of Salt Lake City, Utah, exclusive distributor for Union chucks in the states of Utah, Arizona, Montana, and Nevada.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has opened a new office in New Haven, Conn., in order to provide more adequate service for customers in that territory. Temporary headquarters have been established at 152 Temple St. R. H. Hagner, formerly of the Philadelphia office, will be in charge.

ELECTRIC CONTROLLER & MFG. CO., 2700 E. 79th St., Cleveland, Ohio, has appointed the Farr Electric Service, Inc., 228 W. South Temple, Salt Lake City, Utah, representative of the company. The Toronto office of the company has been removed from the Traders Bank Bldg. to 415 Metropolitan Bldg., Toronto.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces a reduction in price on its general-purpose motors amounting to 5 per cent on most lines and 10 per cent on the commonly used sizes of squirrel cage induction motors, effective December 1. The company also announces a unified schedule of discounts for different classes of purchasers.

R. K. LEBLOND MACHINE TOOL CO., Cincinnati, Ohio, has changed its agency connection in the state of California. The company is now represented in lower California by the Eccles & Davies Machinery Co., Inc., 320 S. San Pedro St., Los Angeles, and in northern California by the C. F. Bulotti Machinery Co., 829 Folsom St., San Francisco.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., has purchased the warehouse division and property of the Bourne-Fuller Co. at Cleveland. The property consists of a group of warehouses, with 200,000 square feet of ground area. The plant is equipped with a complete line of bars, shapes, plates, sheets, and other steel products. The Ryerson Co. will add to the facilities and increase the size and range of stock carried.

WESTERN MACHINE TOOL WORKS, Holland, Mich., manufacturers of radial drills and automatic tappers, announce that they have purchased the entire assets of the JOHN STEPTOE SHAPER CO., of Cincinnati, Ohio, and will continue the manufacture of the complete line of Steptoe shapers, which are built in sizes of from 14 to 24 inches, arranged for both cone pulley and motor drive, as desired. The Western Machine Tool Works will also be in a position to furnish any parts required for Steptoe shapers.

GOGAN MACHINE & FOUNDRY CO., INC., 1630 Collamer Ave., Cleveland, Ohio, is erecting a new factory building of brick and steel sash construction, at 1440 E. 55th St., corner of Homer Ave., which will give the company larger and better facilities for the manufacture of shaft heat-treating machines, automobile spring, bumper, bracket, and railroad plate and coil spring, forming and quenching machines, as well as for the manufacture of the company's high-pressure pump-driven bulldozers and bending machines.

JONES & LAUGHLIN STEEL CORPORATION, Jones & Laughlin Bldg., Pittsburg, Pa., was awarded prizes for every product exhibited by the company at the Sesqui-Centennial International Exposition in Philadelphia. A gold medal was awarded to the company for its new "Jalcase" steel, and a grand prize for cold-rolled and cold-finished steel bars. A medal of honor was awarded the Junior beam, a new light-weight structural rolled-steel building section. The statue entitled "Steel," which was presented to the exposition by the company, was also awarded a gold medal.

CLEVELAND TWIST DRILL CO., Cleveland, Ohio, announces the following changes in its organization: Robert S. Glenn, manager of the New York store, has been appointed assistant to the president, Jacob D. Cox, Jr., with headquarters in Cleveland. Oliver B. Hansen, who has been representative of the company in the southeastern territory, with headquarters in Atlanta, Ga., has been appointed manager of the New York store, at 30 Reade St. Irving P. Farnum, for several years representative covering one of the territories served by the Chicago store, has been appointed representative for the southeastern territory.

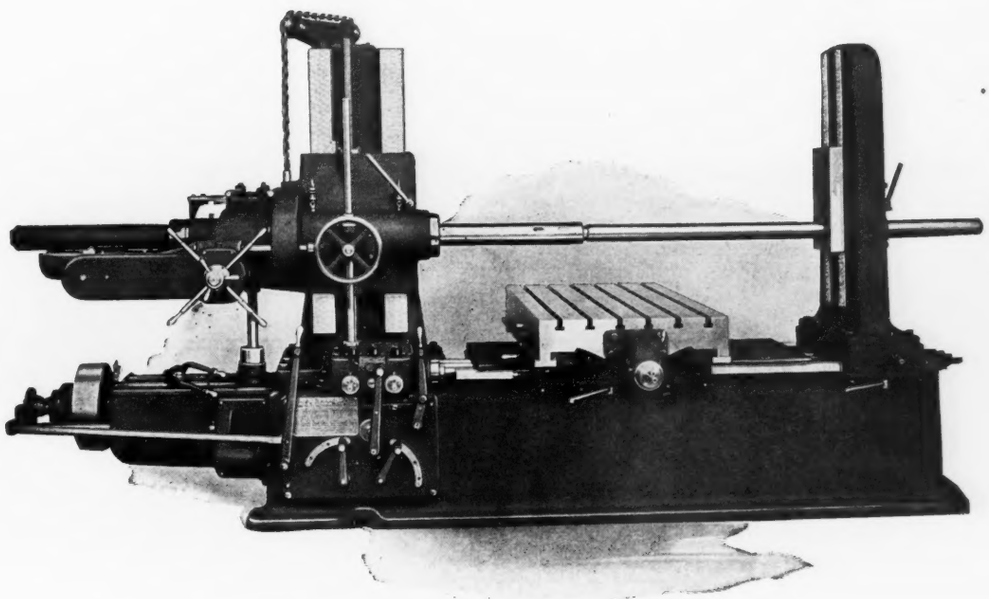
OAKITE PRODUCTS, INC., formerly the Oakley Chemical Co., held its tenth annual conference on industrial cleaning December 6 to 9, inclusive, at the company's offices at 26 Thames St., New York City, and at the Hotel Pennsylvania. A large number of technical papers were read, dealing with cleaning methods in all of the major industries, including the machine shop field, railroad shops, power plants, textile mills, and the automobile industry. Over one hundred men of the technical laboratory, sales and service staffs were present, including nearly eighty field service men employed by the company. Group discussions dealing with each of the major industries were held, at which the men particularly interested in some specific industry had an opportunity to exchange ideas.

* * *

PRIZES FOR ARC WELDING DEVELOPMENTS

In order to stimulate the growth of electric arc welding, the Lincoln Electric Co., Cleveland, Ohio, manufacturer of electric arc welding equipment, has given to the American Society of Mechanical Engineers, $17,500 to be used as cash awards for the three best papers on arc welding developments to be submitted in a competition during 1927. The awards will be $10,000 for the first prize; $5000 for the second prize; and $2500 for the third prize. The awarding of the prizes will be under the direction of the Council of the American Society of Mechanical Engineers and a special committee to be appointed. Rules for the competition are to be announced shortly.

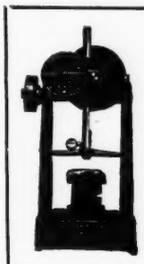
Quality Must Be Paramount—
We Do No Trading on Past Reputation



The Quality of the

"PRECISION"

Boring, Drilling and MILLING MACHINE



WE ALSO MAKE THE
LUCAS POWER
Forcing Press

is not only kept up, but improved whenever possible.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Turin, Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Schuchardt & Schutte, Berlin.

OBITUARIES

WILLIAM LARIMER JONES, president of the Jones & Laughlin Steel Corporation, Pittsburg, Pa., died at his home in Pittsburg on November 25. Mr. Jones graduated from Princeton University in 1887 with the degree of Bachelor of Science, and from the time of his graduation until his death he was occupied with the production of steel. He went directly from college into the mills in Pittsburg as assistant to his father, who was general manager of the company now known as the Jones & Laughlin Steel Corporation. When his father died in 1889 he succeeded him as general manager. In 1906 he was elected vice-president of the company, and in 1922, upon the formation of the present Jones & Laughlin Steel Corporation was made its president. Mr. Jones was a member of the American Iron and Steel Institute, the American Institute of Mining and Metallurgical Engineers, and the Engineers' Society of Western Pennsylvania.

HARRY M. GILES, general superintendent of the South Philadelphia plant of the Westinghouse Electric & Mfg. Co., died December 14 at Atlantic City, from heart trouble, at the age of fifty-seven years. Mr. Giles began his engineering career as testing engineer with the Corliss Steam Engine Co. of Providence, R. I., where he was employed from 1886 to 1893. He was then, for seven years, chief engineer of the Calumet & Hecla Mining Co., until he went to the Westinghouse organization in 1900 as superintendent of the Corliss engine department. He was later promoted to the position of marine superintendent, and in 1919 he was transferred to the South Philadelphia plant as general superintendent. Mr. Giles was a member of the American Society of Mechanical Engineers and the Foundrymen's Association.

MARK FLATHER, president of the Grover File Co., Nashua, N. H., died at his home in that city November 25, at the age of seventy-five. Mr. Flather was one of the pioneers in the machine tool industry, having been engaged in the manufacture of machine tools and machinery for the furniture industry and the electrical trade from 1885 to 1912, during which period he contributed many new ideas and designs to the development of planers, shapers, and lathes.

GEORGE E. LUKE, head of the insulation section of the Westinghouse Electric & Mfg. Co.'s research department, died suddenly on November 28, aged thirty-four years. Mr. Luke was born in Seneca, Mo., and was a graduate of the Missouri University and of Princeton University, having taken up post graduate work at Princeton. He became connected with the Westinghouse Electric & Mfg. Co. in 1917.

COMING EVENTS

JANUARY 8-15—National Automobile Show to be held in New York City under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

JANUARY 25-28—Annual meeting of the Society of Automotive Engineers in Detroit. Coker F. Clarkson, 29 W. 39th St., New York City, secretary.

JANUARY 29-FEBRUARY 5—National Automobile Show to be held in Chicago, Ill., under the auspices of the National Automobile Chamber of Commerce, 366 Madison Ave., New York City.

MAY 23-26—Spring meeting of the American Society of Mechanical Engineers at White Sulphur Springs, W. Va., with headquarters at the Greenbrier Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 25-28—Spring meeting of the Society of Automotive Engineers at French Lick Springs, Ind. Coker F. Clarkson, 29 W. 39th St., New York City, secretary.

JUNE 6-10—Annual convention of the American Foundrymen's Association to be held in Chicago. No exhibition of equipment will be held this year in conjunction with the convention. C. E. Hoyt, executive secretary, 140 S. Dearborn St., Chicago, Ill.

JUNE 20-24—Annual meeting of the American Society for Testing Materials at French Lick Springs, Ind. Secretary's address, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

SEPTEMBER 7-9—Seventh annual New Haven machine tool exhibition to be held in New Haven, Conn. Harry R. Westcott, Chairman Exhibition Committee, 400 Temple St., New Haven, Conn.

SEPTEMBER 19-23—Ninth annual convention and exposition of the American Society for Steel Treating to be held in Convention Hall, Detroit, Mich. For further information, address W. H. Eiseman, National Secretary, 4600 Prospect Ave., Cleveland, Ohio.

SEPTEMBER 19-24—National Machine Tool Builders' Association Exposition to be held in Cleveland, Ohio, under the direction of the association. For further information, address National Machine Tool Builders' Exposition Manager, Room 635, 1328 Broadway, New York City.

NEW BOOKS AND PAMPHLETS

MANGANESE STEEL—A BIBLIOGRAPHY. By E. H. McClelland and Victor S. Polansky. 60 pages, 5 by 7 inches. Distributed by the Carnegie Library of Pittsburg, Pittsburg, Pa.

A TRICHROMATIC COLORIMETER SUITABLE FOR STANDARDIZATION WORK. By J. Guild. 24 pages, 7 by 10 inches. Reprinted from the Transactions of the Optical Society. Distributed by the author, J. Guild, Lalbagh, Park Road, Teddington, Middlesex, England.

A. S. T. M. TENTATIVE STANDARDS (1926). 1100 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price, paper-bound, $7.50; cloth-bound, $8.50.

This is the 1926 edition of the book of A. S. T. M. tentative standards, issued annually. The present volume contains 227 tentative standards. This term is applied to a proposed standard which is printed for one or more years with a view to eliciting criticism before final action is taken.

STATISTICAL ABSTRACT OF THE UNITED STATES (1925). 846 pages, 6 by 9 inches. Published by the Department of Commerce, Washington, D. C. Price, $1.

This is the forty-eighth annual issue of a statistical abstract of the life and business of the American people. It represents a digest of data collected by all the statistical agencies of the national government, as well as those of a considerable number of private agencies and one or two states. The statistics cover a wide range of subjects, among which are area and population; vital statistics; immigration and emigration; education; public lands and national parks; government finances; business finance; wages; foreign commerce; farms; forests; mining and mineral products; manufactures; etc.

PATENTS. By Roger S. Hoar. 232 pages 5 3/4 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

This book has been written to acquaint business executives with a sufficient amount of patent law to enable them to handle intelligently problems that may arise in connection with patents and to decide questions of patent policy. It contains suggestions for getting a patent through the Patent Office, protecting it from infringement, and using legal advice to best advantage. Legal papers and forms for contracts necessary in patent practice are explained. The text is divided into eighteen chapters headed as follows: What Is a Patent?; What Is Patentable?; Anticipation and Domination; Who Is Entitled to a Patent; Infringement; Patent Office Procedure; Patent Office Tactics; Interferences; Protecting an Invention; Conflicting Rights; The Choice of an Attorney; Legal Papers; Searches; Interpretation and Validity; Organizing a Patent Department; Forms for Patent Contracts; Foreign Patents; Misconceptions Summarized.

ELEMENTARY MECHANISM. By A. T. Woods and A. W. Stahl. Revised and rewritten by Philip K. Slaymaker. 250 pages, 6 by 9 inches. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price, $3.

This is a revised edition of a book on kinematics, or elementary mechanism, first published many years ago. The book was originally prepared in the form of lectures to meet the needs of classes of mechanical engineering students. The object was to give a clear description of mechanical movements of practical use and to discuss the principles upon which they depend. The original text has now been largely rewritten and considerable material has been added. A new chapter has been written on the subject of instant centers, in which a number of modern applications are discussed. The chapters on gears and gear teeth have been rewritten, and the involute system given first place, rather than the cycloid as presented in the former edition. An effort has been made throughout to introduce modern applications and bring the book as far as possible up to date without making it too large for classroom use. The subject matter has also been regrouped and the order entirely changed.

CALENDARS RECEIVED

UNION SWITCH & SIGNAL CO., manufacturer of drop-forgings, Swissvale, Pa.

MOLINE TOOL CO., manufacturer of "Hole Hog" drilling machines, Moline, Ill.

WHITMAN BARNES-DETROIT CORPORATION, manufacturer of twist drills, reamers, milling cutters, etc., 2108 W. Fort St., Detroit, Mich.

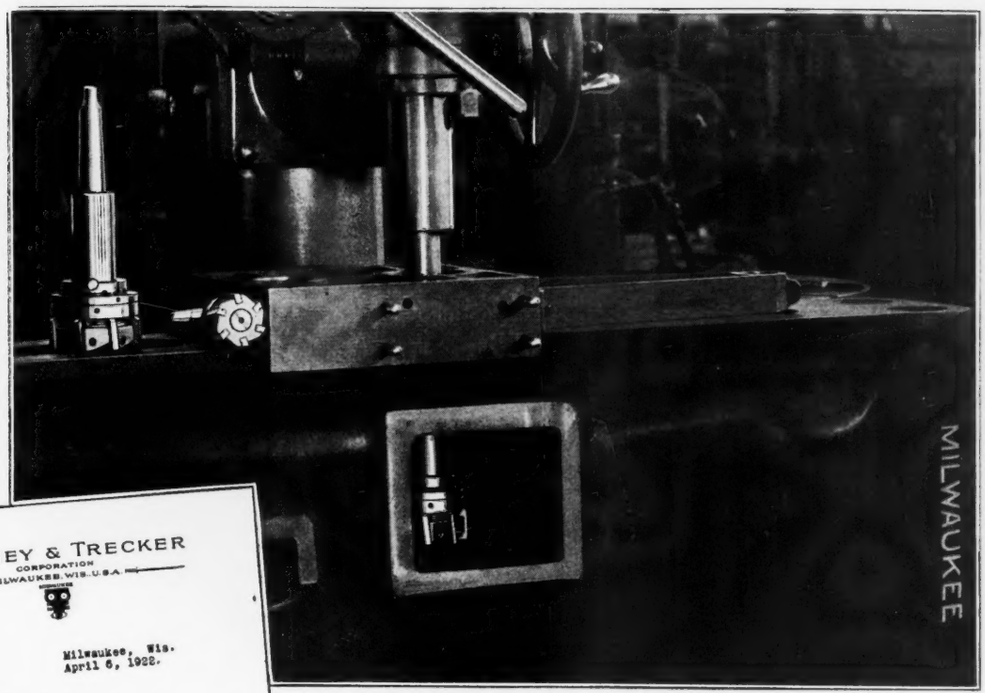
NEW CATALOGUES AND CIRCULARS

ROLLER BEARINGS. Timken Roller Bearing Co., Canton, Ohio, Leaflet illustrating the features of construction of Timken roller bearings.

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Bulletin 14, on electric furnace steel castings, dealing with the subject of pouring.

ELECTRIC EQUIPMENT. Wagner Electric Corporation, St. Louis, Mo. Bulletin 136, illustrating and describing Wagner transformer tap changers.

THREADING TOOLS. F. J. Leggott, 20 Cleveland St., Battle Creek, Mich. Leaflet illustrating a new circular threading tool for inside threading.



KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS. U.S.A.

Milwaukee, Wis.
April 6, 1922.

The Wetmore Reamer Co.,
62 - 27th St.,
Milwaukee, Wis.

Gentlemen:-

In accordance with your request to our Mr. Taylor, we are pleased to advise that the Wetmore Reamers, which have been adopted as our standard shop reamer, are performing very good and are a tremendous improvement over our old system.

Trusting this information may be of value to you, we are,

Yours very truly,

KEARNEY & TRECKER CO.

CBD.R

KEARNEY & TRECKER

Makers of famous MILWAUKEE Milling Machines *have standardized* on WETMORE REAMERS since 1922.

FOR years, Wetmore Adjustable Reamers have been standard equipment in the great plant of Kearney & Trecker, manufacturers of the famous *Milwaukee* Milling Machines.

In April 1922, Kearney & Trecker wrote us the letter shown at the left. Illustrated above is their latest Wetmore Reamer equipment, purchased only recently.

Year after year, Wetmore Adjustable Reamers, of practically every type, have faithfully served this well-known manufacturer. Unusual accuracy, greater speed and dependability, and maximum economy have established this preference for Wetmore, "the Better Reamer."

The shop view shown above illustrates Wetmore Shell Reamers, Type No. 7, at work on a MILWAUKEE Milling Machine in the Kearney & Trecker plant, Milwaukee. (This sturdy Reamer is illustrated and described on Page 12 of the new Wetmore catalog.)

WETMORE REAMER COMPANY
60 27th Street MILWAUKEE, WIS.

WETMORE ADJUSTABLE REAMERS
"THE BETTER REAMER"

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheet No. 173 FE for loose-leaf binder, describing the application of ball bearings to lathe centers.

STEEL. Ludlum Steel Co., Watervliet, N. Y. Pamphlet descriptive of "Nitralloy," a special steel capable of being casehardened at low temperature without deformation.

DRILL CHUCKS. Union Mfg. Co., New Britain, Conn. Circular containing dimensions and prices of the New Britain hand-operated ball-bearing wrenchless drill chuck.

TURRET LATHES. Acme Machine Tool Co., Cincinnati, Ohio. Circular illustrating and describing the No. 2 full universal Cincinnati Acme turret lathe with duo control.

TRACTION DYNAMOMETER. Robert Miller, 4725 Lancaster Ave., Philadelphia, Pa. Booklet descriptive of the "Duplex System" for testing diamond wire-drawing dies.

FURNACE SCREENS. E. J. Codd Co., 700 S. Caroline St., Baltimore, Md. Circular illustrating and describing Wiegand patent chain furnace screens for furnaces and ovens.

ELECTRIC FURNACES. W. S. Rockwell Co., 50 Church St., New York City. Bulletin 276, illustrating and describing a new Rockwell line of electric furnaces of the revolving rotary type.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Circular entitled "Your New Milling Machines," illustrating and briefly mentioning the features of the company's machines.

TACHOMETERS. Coats Machine Tool Co., Inc., 110 W. 40th St., New York City. Circular illustrating and describing Coats hand tachometers and Coats recording indicators of the chronometric type.

WIRE-FORMING MACHINES. Baird Machine Co., Bridgeport, Conn. Circular illustrating Baird wire-forming machines, spring-making machines, presses, straighteners, tumbling barrels, etc.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEA-451, descriptive of the MT control system for direct-current motors. Bulletin GEA-548, on pedestal bases for vertical motors.

STAINLESS STEEL AND IRON. The American Stainless Steel Co., Commonwealth Bldg., Pittsburg, Pa. Pamphlet entitled "Stainless in Industry," showing the many applications of stainless iron and steel.

CHUCKING LATHES. Jones & Lamson Machine Co., Springfield, Vt. Folder illustrating the J & L 17-inch chucking lathe. The circular gives complete details regarding a typical operation performed on this machine.

MILLING MACHINES. Ingersoll Milling Machine Co., Rockford, Ill. Folder illustrating types of milling machines especially adapted for use in railroad shops. Data concerning the various jobs illustrated are included.

CLEANING MATERIALS. Oakite Products, Inc., 26 Thames St., New York City. Bulletin containing an illustrated description of the uses of "Oakite" in the producing, refining, and distributing divisions of the oil industry.

GRINDERS. Blanchard Machine Co., 64 State St., Cambridge, Mass. Circular illustrating Blanchard grinding machines and typical work performed on these machines. Complete data regarding the particular job illustrated is included.

FANS AND BLOWERS. American Blower Co., Detroit, Mich. Bulletin 8001, containing description and complete specifications for American "Sirocco" fans and blowers. Bulletin 2004, illustrating and describing Type SE steel plate blowers.

BOARD DROP-HAMMERS. Erie Foundry Co., Erie, Pa. Circular illustrating a new design of board drop-hammer having a lifting head equipped with four rolls. The improved features of construction of this machine are described in detail.

PUNCHING AND SHEARING MACHINERY. Cleveland Punch & Shear Works Co., Cleveland, Ohio. Circular illustrating Cleveland punching and shearing machinery, power presses, and small tools, such as punches, dies, rivet sets, chisel blanks, etc.

SPEED REDUCERS. Foote Bros. Gear & Machine Co., 220 N. Curtis St., Chicago, Ill. Catalogue 100, covering the IXL line of continuous-tooth herringbone speed reducers, which are made in single reduction, double reduction, and triple reduction types.

SWAGING MACHINES AND DRAW-BENCHES. Standard Machinery Co., Auburn, R. I. Loose-leaf catalogue containing illustrated descriptions of swaging machines, draw-benches, stock straighteners, hand and power shears, wire-drawing machines, etc.

FOUNDRY EQUIPMENT. Whiting Corporation, Harvey, Ill. Bulletin 180, descriptive of the Whiting Class A tumbling mill, equipped with combination clutch and brake. Bulletin 181, descriptive of the Whiting dust filter. Bulletin 182, on the Whiting balanced cupola charger.

GRINDING MACHINES. Cincinnati Grinders, Inc., Cincinnati, Ohio. Catalogue describing the features of construction of Cincinnati plunge-cut grinders. Complete specifications are included for the two sizes in which these machines are made—12 by 18 and 12 by 36 inches.

GEARS. William Ganschow Co., 16 North Morgan St., Chicago, Ill. Illustrated booklet telling the story of this company since its origin about fifty years ago. The illustrations show exterior and interior views of the plant, as well as some of the many classes of gears manufactured by this company.

INDUSTRIAL DIAMONDS. Wheel Truing Tool Co., Detroit, Mich. Booklet entitled "The Diamond and Industry," covering the selection of industrial diamonds and their care. Special attention is given to the use of diamonds as a means of truing abrasive wheels for accurate grinding.

FIREBRICK CEMENT. Botfield Refractories Co., Swanson and Clymer Sts., Philadelphia, Pa. Circular entitled "What Users Say of 'Adamant' Firebrick Cement," containing extracts from letters written by customers. The pamphlet also contains suggestions regarding the use of this material.

TOOLS. Commercial Tool Co., Plymouth Bldg., Cleveland, Ohio, manufacturer of milling cutters, broaches, taps, reamers, and other cutting tools, is distributing a card on which is printed a table of decimal equivalents. The card is perforated so that it can be hung up for convenient reference.

RIVETING MACHINES. Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. Pamphlet entitled "This Is the Age of Riveted Steel," containing a reprint of an address delivered by A. F. Jensen, president of the Hanna Engineering Works, before the American Institute of Steel Construction.

REBUILT MACHINERY. J. L. Lucas & Son, Inc., Bridgeport, Conn. List No. 70, containing data on the rebuilt machines that this company now has on hand, including all types of machine tools and miscellaneous equipment such as chucks, compressors, dies, hoists, testing machines, etc. The prices are given in each case.

STEAM DROP-HAMMERS. Chambersburg Engineering Co., Chambersburg, Pa. Bulletin 205-B, entitled "Type B Steam Drop-hammers," illustrating and describing this design of steam drop-hammer, as applied to different sizes from 600 to 24,000 pounds falling weight. Information relating to larger sizes may be had upon application.

PUMPS. Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill. Catalogue illustrating and describing Tuthill pumps with variable and reversible flow. The catalogue shows the construction of the pump by sectional views, and contains tables of dimensions useful to the designer when incorporating the pump in machine lay-outs.

PRESSED-METAL WORK. Geuder, Paeschke & Frey Co., St. Paul Ave. and 15th St., Milwaukee, Wis. Booklet entitled "Stampings are Cheaper than Castings." The purpose of this booklet is to enable the designing engineer to visualize the possibilities of the use of drawn sheet metals. A number of examples of drawn sheet metal parts are shown.

SILENT GEARS. General Electric Co., Schenectady, N. Y. Catalogue descriptive of "Fabroil" and "Textolite" silent gears. The booklet outlines the construction of these materials, the manufacture, and characteristics. It also gives application data for various installations, and recommended practice for machining gears made of these materials.

PNEUMATIC CONVEYING SYSTEMS. B. F. Sturtevant Co., Hyde Park, Boston, Mass. Catalogue 291, covering the Sturtevant line of pneumatic collecting and conveying systems. Part I of the bulletin describes apparatus used in dust collecting and pneumatic conveying systems. Part II contains data on the design and application of collecting systems.

BABBITT METAL. Hoyt Metal Co., Boatmen's Bank Bldg., St. Louis, Mo. Booklet entitled "Babbitt Metal Data," containing information on the selection of babbitt metal, the design of babbitt bearings and casting and fitting the bearing. A table is also included giving various properties such as Brinell hardness, melting point, specific gravity, etc., of various babbitt metals.

STEEL. Jones & Laughlin Steel Corporation, Jones & Laughlin Bldg., Pittsburg, Pa. Handbook on the use of "Jalcase"—a new free-cutting open-hearth steel especially adapted for casehardening and heat-treating and for forging where machineability is important. The booklet contains technical information on characteristics, machineability, casehardening, physical properties, and heat-treatments.

DROP-FORGINGS AND DROP-FORGED TOOLS. J. H. Williams & Co., Buffalo, N. Y. Catalogues of drop-forgings and drop-forged tools published in two sizes, one 7½ by 10½ inches, and a pocket-size, 4 by 6 inches, covering practically all the goods shown in former catalogues of the company and, in addition, the complete line of "Superrenches" in five patterns; "Superrench Silent Salesman" display board; Vulcan tongs; light service C-clamps; and drop-forged carbon steel wrenches with new finishes. The catalogues contain 200 pages.

GEARS. Foote Bros. Gear & Machine Co., 232-242 N. Curtis St., Chicago, Ill. Catalogue 200, entitled "Gear Problems and IXL Speed Reducers." This is a general catalogue covering all the classes of industrial gears made by this company, including spur, bevel, miter, worm, internal, helical, spiral, and herringbone gears and racks of different materials. The catalogue contains many illustrations showing applications of the various types of speed reducers, and contains complete specifications, including price lists, as well as data, tables, and formulas, relating to gearing.

NICKEL STEEL. International Nickel Co., 67 Wall St., New York City, is publishing a series of bulletins containing nickel steel data. The following nine bulletins have been issued to date: No. 1, "Society of Automotive Engineers' Standard Specifications for Steels"; No. 2, "Physical and Mechanical Properties of Nickel Steels"; No. 3, "Heat-treatment and Applications of Nickel and Nickel-Chromium Steels"; No. 4, "Making Steel Castings Stronger"; No. 5, "The Mill Inspection of Steel"; No. 6, "Alloy Steel Reduces Die-block Costs"; No. 7, "Automobile Design and Automotive Steels"; No. 8, "Improving Gray Cast Iron with Nickel"; No. 9, "Physical Properties of Nickel and Nickel-Chromium Steels." Loose-leaf binders to facilitate filing are furnished upon request.